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AN EXPEDITION TO NORTH WEST GREENLAND AND THE CANADIAN ARCTIC IN 1937

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LAST summer's expedition to Baffin Bay was a sequel to a voyage with somewhat similar objectives in 1934. Both had Ellesmere Land as their farthest north point, but in 1934 an early arrival at Thule in North West Greenland was planned so as to be there during the nesting season, and this had meant leaving this country at the end of May so as to be at Thule in the middle of June. Last summer we had no such urgency and could wait to cross Melville Bay at the beginning of August, when it is almost invariably open. By a trick of fate we could probably have reached Thule any time in June in 1937, whereas in 1934 we were held up by unbroken pack-ice for six weeks in Melville Bay, and in the end gave up the attempt to reach Thule, making instead a short visit to North East Baffin Land. In 1937 the geographical objective was again Ellesmere Land, followed by Lancaster Sound or Baffin Land, but this was to be preceded by high altitude cosmic ray investigations in West Greenland. This had not been the first plan, which had been to go direct to Smith Sound to study Eskimo origins in Ellesmere Land and carry out geographical exploration in the Canadian Arctic, but as a result of encouragement and grants from different quarters cosmic ray work became in the end the most important part of the programme.

The idea originated in suggestions from T. T. Paterson, who had been with me in 1934 and considered that the Melville Bay weather which we had experienced that year was particularly suitable for high altitude balloon flights such as were desired by cosmic ray investigators near the North Magnetic Pole. E. G. Dymond and H. Carmichael became interested, and in October 1936 began constructing light-weight apparatus for measuring cosmic rays at the greatest possible heights. Their investigations had to be made at high altitudes as the rays are strongly absorbed in the lower levels of the atmosphere. The proposed method was to have the apparatus lifted by two freely floating balloons, each 8 feet in diameter, which would reach

a height of 15–20 miles before bursting, and as soon as one or the other burst, the second, acting somewhat like a parachute, would then bring the attached instruments gently back to sea-level. Previous work by similar methods in temperate latitudes, undertaken by Professor Regener, Professor Millikan, and others, had shown an increase in cosmic ray intensity away from the equator. Our object therefore was to measure the intensity in high magnetic latitudes, and as near the magnetic pole as possible, not however the North Magnetic Pole on Boothia Felix, but the position of the Earth's magnetic axis when the distorting effects caused by local conditions of the Earth's crust are eliminated. This idealized pole is known as the Geomagnetic Pole, and is situated in Greenland east of Smith Sound about two degrees north of Thule.

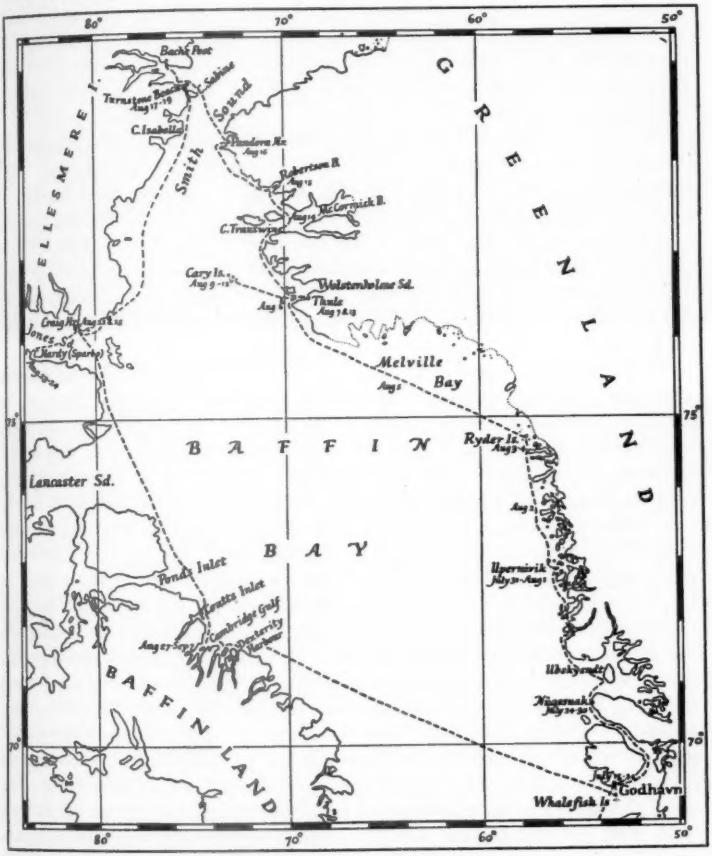
Two types of apparatus were to be flown with the balloons. Carmichael's, which was designed and constructed in the Cavendish Laboratory at Cambridge, consisted of a light-weight ionization chamber with electroscope, and a small camera which photographed the latter at work and at the same time recorded the temperature and atmospheric pressure; the principle was not original, but the construction of the apparatus, of which there were ten sets, was considerably modified and improved. Dymond's apparatus was a triple-coincidence Geiger counter set with wireless transmission both of the counts and of the barometric pressure; this was a less well-known method and not so likely to succeed at its first trial. Dymond was at work on it throughout last winter and constructed five sets at the Physics Department in Edinburgh, and as regards the wireless part he had the active help of Mr. J. A. Ratcliffe working at Cambridge. A feature of the Dymond apparatus was the fact that it need not be recovered, but it was essential that Carmichael's should be picked up in order to secure the photographic record. We had two strings to our bow, therefore, but whichever we used clear weather with a minimum of wind was desirable to be able to follow the balloons in flight, and in Carmichael's case to make certain of recovery. In inhabited lands apparatus can be recovered without trouble, but on the sparsely populated West Greenland coast we had to depend on picking up the apparatus out at sea, and knew that if it came down among the coastal mountains or on the inland ice it was irrecoverable. We were uncertain as to wind direction at high levels, and if this were to be dominantly from the west, taking the balloons inland over the ice-cap, it meant that results might only be obtained with the Dymond apparatus unless we could get well up to windward out in Baffin Bay and find suitable launching conditions for Carmichael's on the western pack-ice.

It will be clear how much preliminary laboratory experiment was necessary throughout last winter. The cost of making the instruments and buying the balloons was considerable, and in this connection the expedition is particularly indebted to Professor Barkla in Edinburgh and to the late Professor Lord Rutherford in Cambridge for generous grants from their departments towards the construction and purchase of the instruments, and to the Carnegie Trust for the Universities of Scotland for help in purchasing the balloons; in addition the Royal Society made a grant of £800. I should also like to take this opportunity of thanking Dr. J. Donald Pollock for defraying the cost of the hydrogen, and the British Oxygen Company for the loan of cylinders and apparatus; and Professor Regener in Stuttgart and Professor Millikan in Pasadena for the loan

of their respective instruments constructed for ground observations of cosmic radiation. The total cost of the expedition was £3400, of which about £1500 represented the grants mentioned above, while the balance was contributed by members of the expedition.

North Atlantic and Davis Strait

We were due to sail from Leith towards the end of June with a party of



Sketch map showing the route of the "Isbjörn"

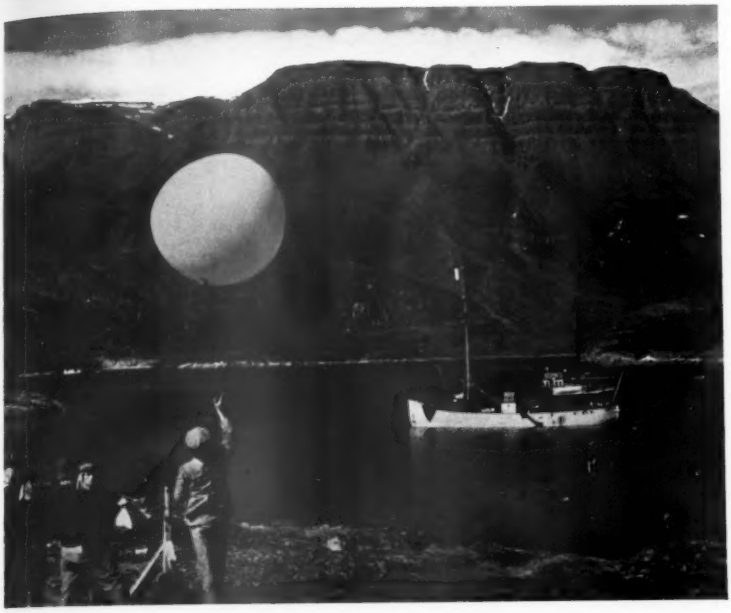
ten. Dymond and Carmichael were responsible for the cosmic ray work and in addition I. M. Hunter was in charge of wireless from the balloons, while of the others T. C. Lethbridge, T. T. Paterson and R. W. Feachem went primarily as archaeologists, and H. I. Drever, A. H. Robin, and E. D. W. Leaf as geological and topographical surveyors. Side-lines of importance were a collection of plants undertaken by Feachem and a study of Eskimo string

figures by Paterson. This large party was accommodated with some difficulty in the Norwegian motor sealing vessel *Isbjörn* of Tromsö, 172 tons net, with a crew of twelve, made up of captain, two mates, two engineers, four deck-hands, cook, cook's assistant, and wireless operator. She is a well-known ice ship, with powers of rapid penetration through close pack-ice, due to quick helm response through having no keel, and she has an additional advantage of great importance, as she has a steaming range of at least eighty days at the economic speed of 6–7 knots, which freed us from all anxiety as regards fuel. The details of the oil consumption are worth putting on record, namely that she can steam for four days of twenty-four hours on 3 metric tons of oil; she left Leith with 61½ tons on board, and after a ninety-six day interval arrived back with 9½ tons in the tanks.

The *Isbjörn* reached Leith from Norway on June 25, took our party on board, and left early on the 27th bound for Godhavn on Disko Island. Next morning strong westerly winds headed us through the Pentland Firth, and in the afternoon we thought it best to run into Loch Eriboll for shelter, as the lack of keel, while very suitable for worming through ice, made difficult steering against head seas and contrary winds, and progress in these conditions was slow and uneconomical. Two days were spent in Eriboll, and we did not therefore start on the Atlantic passage westwards from Cape Wrath till July 1.

There had been a period of very unsettled weather in the North Atlantic area, but more was to follow, and the ship was hove to three times on the passage to Cape Farewell, which in favourable weather should normally take seven to eight days. Twice this was the result of head winds, but on the last occasion our trouble was a strong following gale, when on the ninth day after leaving Eriboll a moderate easterly breeze rose to a full gale from north-east, and we ran before the wind, decks awash, the ship lurching forward as the heavier waves lifted her onwards. We were near Cape Farewell, but some way to the south, to avoid ice and also the windier region round the Cape itself, and we were on a lee shore should the ice stream of the East Greenland current be far south. The ice as it happened was not far off, the watch reporting an occasional piece seen in the darkness, and our only course was to wait with the ship again hove to even though the wind was a following one. We remained in this way till the 11th, when the weather improved and we attempted a more northerly course. Then almost suddenly the sea flattened out, though the wind was still fairly strong, and we knew that we must now be to leeward of the unseen pack-ice and into Davis Strait. The quick change to moderate seas, which may be expected under these conditions, is as welcome and sudden as when a small ship in a gale rounds a break-water into harbour.

In Davis Strait we had overcast conditions with mist and a gentle head swell during the four days' passage to Godhavn. There was a short clearing one evening off Godthaab, enough to show the characteristic mountains, Sadlen and Hjortetakken, known as the Beacons of Godthaab, and by this means we fixed our position, having been without sights for five days. This was only a temporary improvement however and for the most part we were limited to 5 to 10 mile visibility in the passage up the Strait. North of 64°



Pilot balloon flight, Godhavn

Launching Dymond's apparatus and the start of the flight, Nûgssuak Peninsula

Eskimo hunters at Robertson Bay

Amaunalik demonstrating string figures to Paterson

we were on the cod banks, and passing sailing ships at anchor at intervals along a 200-mile stretch. As a rule these were schooners and barquentines, old ships ending their days, the bigger ones under French or Portuguese flags, and the smaller ones from Nova Scotia or the Faeroes. These old-timers act as parent ships and the method of fishing is by hand-line from dories scattered over a wide area. In the mist we would come on the latter rising gently in the swell and labelled with the parent ship's insignia, such as a big maltese cross, the parent ship in this case being the *St. Maria Manauela*, a steel-grey four-masted schooner from Oporto.

Disko Island

Godhavn was reached on July 15, and preparations at once began for the first balloon flight. The weather at Disko is almost proverbial, and we had specially chosen Godhavn for our first attempts, as it offered an ample sector of open water for recovery of the balloon apparatus, and in addition to probable fine weather and a wide area of open sea there were the further advantages of a good anchorage, high ground for look-out purposes, and also prominent points which could be easily occupied as the ends of an observation base-line. We had decided that the smaller pilot balloons, which were to be flown daily to test weather conditions, should be under as careful and continuous observation during flight as the larger instrument-carrying balloons. In this way in addition to the main object, which was to predict the probable landing place of the instrument balloons, we were also able to make a study of the movements of the upper air. Observers had to be trained in instrument use and in routine, and this was done with the pilot balloons, each about 4 feet in diameter, during the first three days of our stay, while Dymond, Hunter, and Carmichael were unpacking and assembling their instruments. A base was laid out, one end near where McClintock's *Fox* lies, her ribs and keel still exposed at low tide, the other about 1 mile distant across the harbour at the "watering place." Each end of the base was manned by three men, using one or other of three instruments, an Air Ministry balloon theodolite offering a large field but coarse readings, a Watts $3\frac{1}{4}$-inch theodolite permitting sharp readings of arc, and an astronomical telescope. Of these the Watts theodolite gave the most accurate results, and the others were by way of safeguard, and at the worst if the observers at one end of the base lost sight completely of the balloons by mist or faulty observation, the other set of observers would still have a check on distance by using the telescope which was provided with a graticule to enable subtense measurements to be made. These first three days were perfect in every way, and by then the men and instruments were all ready and in order. No finer weather was experienced at any other time during the summer, the pilot balloons ascended almost vertically, and "Disko weather" was not a mere name. On the fourth day however when all was ready for a full flight, conditions changed slightly, and though preparations were made, mist and puffy winds soon interfered, and after the balloons had been partially inflated the flight had to be cancelled.

We waited another four days till it was clear that the deterioration in the weather was not merely temporary and then decided to move north to another point. We could not wait indefinitely at one spot, as it was necessary to provide for the interests of the party as a whole.

Nûgssuak Peninsula

We left early on July 24 and during a day of mist and fog passed up the Vaigat, aiming to anchor at the western end of Nûgssuak Peninsula. By now we knew that there was practically no pack-ice in Davis Strait, and had therefore given up the idea of launching the balloons out at sea. The Nûgssuak Peninsula juts prominently westwards, and appeared to have much the same strategic advantages as Godhavn, there being a small fairly sheltered harbour, near the extreme west point. The approaches are narrow, and it was only with the help of local Greenlanders that we were able to feel our way in and secure the ship by a combination of anchoring and tying up to ring bolts. The harbour lay lengthwise between dipping ledges, and is not much more than a boat harbour, and ours was probably the limit of size of ship which can be accommodated.

The weather at Nûgssuak was disappointing, and there was a good deal of wind and cloud; flights were only possible with Dymond's apparatus. Two were made during a stay of five days, but neither was completely satisfactory. In each case the balloons were inflated ashore, about three hours being necessary for this and for the preliminary work of preparing the wireless apparatus. A string consisting of two balloons each 8 feet in diameter, the controlling parachute, and finally the cellophane-protected instrument was then launched as soon after local mean noon as possible, as Dymond's apparatus worked best under warm conditions. The pilot balloons ascended rapidly at an average rate of 13 miles per hour, but in contrast the large balloons travelled at little more than half this speed, and rose in majestic fashion. On the first flight clouds prevented ground observation of the balloons, and the wireless transmission proved unsatisfactory. On the second flight on July 29 the first balloon burst after two-and-a-half hours in the air, but as far as cosmic ray results went, after one-and-a-half hours' good transmission, alternately of pressure and cosmic ray intensity, there was a sudden stoppage of the wireless. It was clear that there was some instrumental failure both on this and on the earlier attempt which would make it necessary to recover and examine the apparatus after the next flight.

In other respects the stay at Nûgssuak was very successful, and particularly so for Drever. The ledges of the harbour are inclined lava-flows, part of the Tertiary volcanic rocks which cover Disko Island and a wide area farther north, and one of the problems during our stay at Nûgssuak was to locate the central focus of this widespread volcanic activity; hitherto only the superimposed lava sheets have been known, and nothing definite of their place of origin. During our stay Drever located an unrecorded dyke-swarm about 10 to 12 miles distant along the south coast of the Peninsula, and a gabbro intrusion, the first recorded in the West Greenland Tertiary, on the south coast of Ubekjendt Island.

Ryder Islands and Melville Bay

We were now ready to move on to the third strategic point, which we had decided should be at the Ryder Islands in lat. 74° 40′ N. Upernivik was reached in the early evening of July 31 and left late the next night, the visit being no more than a formal call to report to the Governor that we were in

his region. Meantime Dymond, Robin, and Drever climbed to the summit of Hope Sanderson (Kaersorssuak), the high landmark immediately to the south of Upernivik which marks John Davis' farthest in 1587. We were abreast of the Ryder Islands in roughish weather late on August 2, and at 2 a.m. on the 3rd took shelter from a strong south wind under the lee of Amdrup Island.

The next three days are an interesting record of rapid weather changes and ups and downs of fortune. We had anchored early on August 3 to take shelter from a cold southerly wind, but by the forenoon the weather was mild and encouraging, the sky cleared and the sea began to go down. Meantime various members had been left ashore, some on South Ryder, others on the North-West island, at places where archaeological investigations had been made in 1934. By the afternoon however it became evident that the weather conditions had steadied quite unexpectedly and were by then exceptionally good; the scattered parties were hurriedly recalled and preparations made for a flight with Carmichael's apparatus. It was already late in the day, but Carmichael's apparatus did not require the same warm conditions as Dymond's. A pilot balloon was flown about 3 p.m. and, in its one-and-a-half hour ascent to a height of about 20 miles it drifted very slightly to the N.N.W. A rocky ledge only a little above high-tide level on the west side of North-West Ryder Island was chosen as the launching ground, and hydrogen piped to the balloons from a rowing boat, the swell being too heavy to handle the cylinders ashore. We worked as quickly as we could, for every one knew his particular task by now, but it was not till about 8.30 p.m. that the balloons were finally released. The balloon flight that night was most impressive as the big yellow balloons rose into the clear sky; the air was calm, but a restless sea was still breaking round the launching ledge and against some great stranded icebergs. The balloons reached their maximum after about two hours, when the upper one burst, and then in a somewhat shorter space of time the remaining balloon and the attached apparatus descended with slight eddying motion and were recovered shortly after midnight less than 2 miles from the place of launching. This was a completely successful flight to a height of nearly 18 miles and gave Carmichael a record of practically all he wanted to find. We had, in fact, realized our hopes for at least one good flight.

It seemed that our luck had turned, and we planned that a Dymond flight should take place next day, but on the 4th the pilot balloon was almost immediately carried north-eastward towards the ice-cap, only 15 miles away. It later passed beyond the disturbed layers and completed its flight by rising vertically, but it was of course clear that no apparatus could be recovered if the slower big balloons, whose deflection on the double journey would be nearly four times as much, were flown in these conditions. The flight was cancelled, but we had at least the satisfaction of knowing that we had not failed to take quick advantage of the odd chance of still weather on the previous day.

A course was now set across Melville Bay for Cape York, the crossing being made on August 5 in about twenty hours, in a northerly wind with heavy rain. No pack-ice was seen, visibility was at its worst, and all we saw of Cape York next evening were the lower slopes looming in the mist, followed by the

glacier-divided Crimson Cliffs. Then the weather improved again and on August 6 we arrived at Thule in still weather and bright sunshine.

We had hopes of determining the trouble in Dymond's wireless and of completing the balloon experiments during the next week, knowing that later there was much less likelihood of favourable weather on Ellesmere Land and Baffin Land. On August 7 Paterson and Drever were left at the Thule trading post and the ship proceeded to the east side of Wolstenholme Island, where a flight with Dymond's apparatus was made on the 8th to a height of over 12 miles. The descending balloon drifted gently eastwards over the land and was marked down less than 10 miles inland east of Cape Atholl. Dymond and Robin were therefore landed near a deserted settlement at Narssûrssuk in order to recover the apparatus, and if this should not be immediately possible to go on the odd 15 miles to Thule and on the following days quarter the ground from there. The ship meantime proceeded on August 9 to the Cary Islands to see if balloon flights were possible from this mid-water position.

Cary Islands

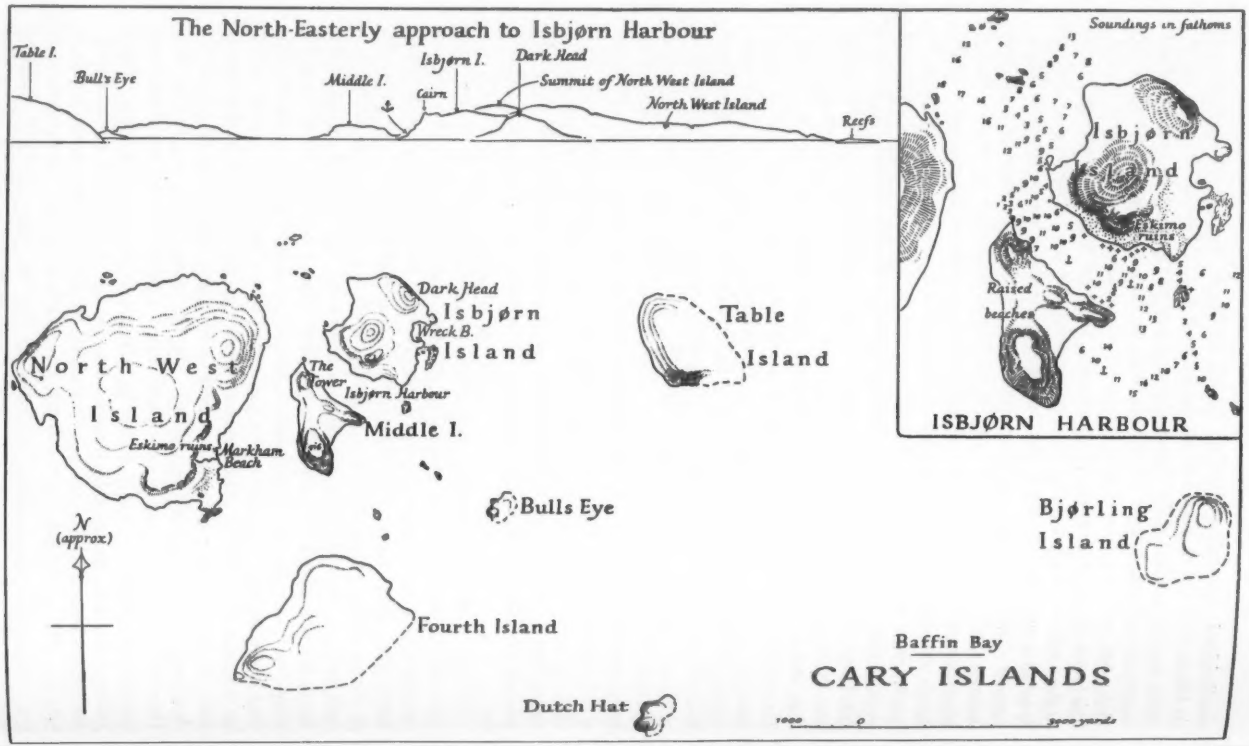
The Cary Islands lie well out from the coast in the wider southern part of Smith Sound, the North Water of the Baffin Bay whalers; but though familiar to these men and often sighted the islands have seldom been visited, largely because of their uncharted condition. The ground among the islands is notoriously foul, and one of the points emphasized by Captain Adams, one of the last of the Dundee whalers who gave us much advice before we sailed, was not to go in among the Cary Islands. The *Windward* was lost here in 1907, and Björling's 40-ton ship, the *Ripple*, was stranded on the South East island in 1892; but to us the islands were tempting by reason of the amount of sea room available for picking up the cosmic ray apparatus, and perhaps also simply because they were islands. The name dates back to Bylot and Baffin's voyage in 1616, and they were named apparently after Alwin Cary, the ship's husband. Ross passed to the westward of the islands in 1818. One of the earliest recorded landings was that made in 1851 by the *Resolute* and *Assistance* on the return voyage of Austin's squadron, when Clements Markham went ashore and found old Eskimo winter-houses; a later visit was in 1875 when Nares in the *Alert* landed at the South East island; and he was followed the same year by Allen Young in the *Pandora*, who was looking for Nares' record but, being misled by Nares, landed on the North West island.[1] More recently, Lauge Koch and Peter Freuchen landed from a motor boat on the South East island in August 1916, and Commander Riis-Carstensen spent a day there with the *Godthaab* in 1928.

Our approach was made from the east, passing to the south of the south-

[1] Accounts of earlier visits to the islands are not easy to find. Assistant Surgeon Ede wrote about the 1851 visit in the *Aurora Borealis*, the magazine of H.M.S. *Assistance*, afterwards published as 'Arctic Miscellanies.' Markham (aged twenty) was a member of the party and has recorded his own memories in a small book called 'Franklin's footsteps,' and also in footnotes in Young's 'Two voyages of the *Pandora*,' which he edited. The fate of Björling is discussed at length in Axel Ohlin's 'Pa Forskningsfärd efter Björling och Kallstenius,' Stockholm, 1895.

easterly island, now called Björling Island, and from there north-west among the islands with Table Island to starboard and Dutch Hat on the port hand. In this way we headed right through the group to the north-westerly island in spite of Captain Adams' warnings, but we had a motor boat which the whalers had not, and were using it as a pilot and sending it ahead to sound. This lowers the rate of progress to about 2 miles an hour, but except in the roughest weather makes advance comparatively secure. Norwegian sealers do not as a rule carry motor boats, but they are indispensable for expedition purposes and lighten the work enormously. In this case our caution was necessary, and it was only after one or two trial shots that we finally found safe anchorage at the north west group, which consists of three large islands, though previous charts have shown a single island. As we were likely to be here for some days a secure anchorage was the first essential, and in the end we found not only an excellent anchorage between Middle Island and Isbjörn Island, but also that an alternative and better approach was easily made from the north-east down the east side of Isbjörn Island, which appears clean, and clockwise round the dangerous south points into the anchorage. The position was almost landlocked in a small bay where some old Eskimo houses lie on a raised beach below guillemot cliffs 300–400 feet in height. Shelter from the north was given by the shallows between Isbjörn Island and Middle Island, and to the south Fourth Island, about $1\frac{1}{2}$ miles distant, made an effective screen; no swell was noticeable, but there was a fair tide-run. The harbour therefore can be used in all weathers. We arrived on August 9, but a strong wind prevented any balloon work for two days, and it appeared as if the advantage of the mid-water position of the islands was more than offset by unsettled oceanic weather. We decided that it was useless to remain, but by then we were fog-bound for two more days before we could get back to Thule, where the weather meantime had been continuously fine.

The stay at the Cary Islands was therefore a failure as far as the balloons were concerned, but it was profitable in other ways. We had with us two contradictory map representations of the islands, one on British Admiralty charts which dates from the time of the Franklin search, and the other on Dr. Lauge Koch's 18-sheet map of North West Greenland. The latter is a small portion only of Koch's big map, and his visit was limited to the South East or Björling island and cut short by bad weather; thus in spite of its more recent date his outline is a much less correct representation of the group than that adopted by the Admiralty. We had not at first planned any survey work, but as we saw the need for it bits of coast were plotted, and some of the islands circled by motor boat; as soon however as we were aware that an improved chart would be worth making we were almost immediately checked by fog. The result therefore is not much more than a sketch and no positions were fixed astronomically, but it is so far in advance of all previous maps that it justifies being put on record. Detailed knowledge is confined to the north-west group of three islands, or four if Fourth Island, $1\frac{1}{2}$ miles to the south, is included. The rest consist of Table Island some miles to the east, and beyond (the north-west group being regarded as the starting-point) is Björling Island, while Dutch Hat lies some way south-east of Fourth Island. These


The North-Easterly approach to Isbjørn Harbour
Table I.
Bull's Eye
Middle I.
Isbjørn I.
Cairn
Dark Head
Summit of North West Island
North West Island
Reefs
Soundings in fathoms
Isbjørn Island
Eskimo ruins
Raised beaches
ISBJØRN HARBOUR
Dark Head
Isbjørn Island
Wreck B.
The Tower
Isbjørn Harbour
Middle I.
North West Island
Eskimo ruins
Markham Beach
Table Island
Bulls Eye
Bjørling Island
N (approx)
Fourth Island
Dutch Hat
Baffin Bay
CARY ISLANDS
1000 0 3000 yards

are the major islands, but in addition there are many smaller islands, rocks and skerries. The skerries and navigation dangers result from the nature of the rock formation and sudden changes of depth are natural. There are for instance skerries some 2 miles west of North West Island.

The three islands of the north-west group, the only ones on which we landed, are of gneiss, and form part of the basement Archaean rocks which constitute the framework of Greenland and the Canadian Arctic. The monotony is varied by the presence of two massive dolerite sills with a marked northerly dip as at Dark Head, so inclined that the sills pass at sea-level from one island to another, forming shallow and foul ground: the very feature however which gave our anchorage its protection from the north. The dolerite sheets have the further distinction of forming most of the steep inland bird cliffs.

Two particular physiographic features characterize the group. The first is the presence of terraced boulder beaches stepping up like the treads of a staircase to 140 feet or more above sea-level. The great cliffs of the guillemot rookeries are in fact the old sea-cliffs before the movement evidenced by the raised beaches took place. The second feature is the persistent table-top appearance of the island summits. On Middle Island the height is about 375 feet. This must be regarded as either a peneplain or a plain of marine denudation, but it is not a re-exposed Pre-Cambrian surface, as the intruding dolerite sills have shared in the levelling off. It may represent an erosion surface between the Thule sandstone and overlying Cambrian beds: Dr. Koch postulates such an event, but, though such may be the case, I think it more likely from evidence on Ellesmere Land that the Cary Islands summit plain is of later date. The two features—the uniform summit level and old cliffs fronted by raised beaches—produce a tower type of scenery which is very characteristic of the group.

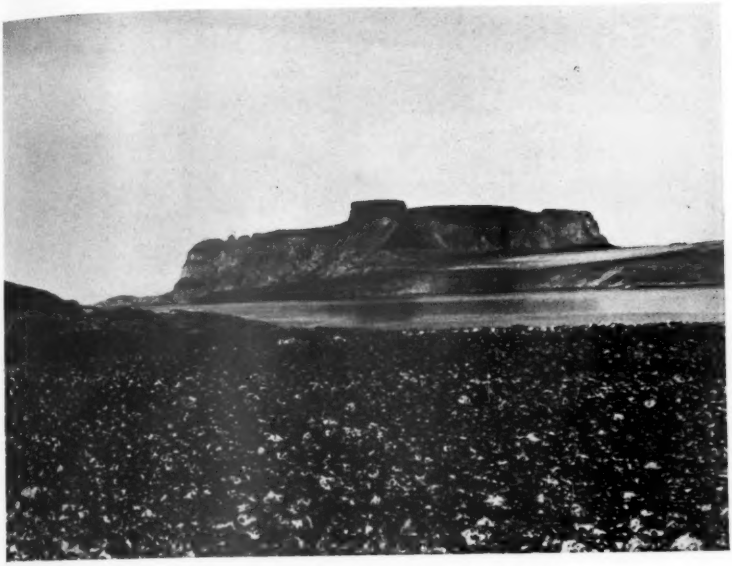
The bird cliffs must yield a plentiful food supply in season; and seals are probably common at other times, as the islands are stated to be fairly open in winter, and the North Water never completely frozen over. We were not surprised therefore to find that there had been old Eskimo villages both on the south side of North West Island and at the ship anchorage at Isbjörn Island. At the former there were the remains of at least five huts, but they had been partly excavated by some previous visitor and only a few whale bones were present. It seems certain that this was the site visited by Markham in 1851, and the chance of making any study of these huts had gone. The anchorage site on the other hand had never been disturbed, and we found two umiak rests and five long houses, each accommodating several families. Whale bones were visible jutting through the turf of the longest house, and the turf was therefore stripped to expose a complete framework of rafters of whale bones. The house was three-roomed, two short walls projecting and acting as rests for the long whale-bone girders; an interesting peculiarity was the symmetrical arrangement of whale scapulae. Measurements were made, but the bones were left untouched just as they were found and no excavations undertaken at this large hut, though digging was done at a smaller house alongside for comparative purposes.

Thule and the Polar Eskimo

We returned to Thule on August 12 and re-embarked our four men. Dymond had meantime recovered his apparatus, and found that the faults were due to overheating by the sun's rays, and at least one further flight was necessary. Next day one of Carmichael's instruments was flown from Thule and retrieved south of Wolstenholme Island, and the ship then proceeded north, and round Cape Parry into Whale Sound of Baffin and Inglefield. We anchored for a night on the north side of McCormick Bay, and on the 15th a call was made at Robertson Bay for a few hours, and a last contact made with David Haig-Thomas and J. W. Wright, who were to winter there preparatory to making a long sledge journey into Ellesmere Land. We had previously been in touch with them and their third man, Hamilton, in the Vaigat, at Upernivik, and at Thule. We were also attracted to Robertson Bay by its being the most northerly permanent Eskimo settlement, now that Etah is no longer occupied in winter, and Paterson was anxious to have this chance of meeting the Robertson Bay hunters, to supplement his observations at the Thule post.

These Eskimo are known generally either as the Cape York Eskimo, or as the Polar Eskimo, the name preferred by Rasmussen, and are descendants of the natives discovered in 1818 by Sir John Ross, who in his picturesque way called them the Arctic Highlanders. In the next seventy years the tribe was seldom visited, except that Scottish whalers generally did a little bartering each year as they passed Cape York, while occasional hunters with their families assisted some of the polar expeditions of the latter half of the nineteenth century, such as those of Kane, Hall, and Nares. By the end of the century however the Polar Eskimo became well known and famous as sledgers, as the outcome of Peary's many expeditions based on Smith Sound. Peary first employed them in 1891 to hunt walrus for his dog food, and finally came to depend on them almost entirely as his dog drivers as well, and the polar journey of 1909 succeeded largely by reason of their great ability as sledgers combined with their loyalty and trust in Peary. For all they did for him Peary made full payment, giving them rifles and iron goods and, to his best men, boats. In this way by 1909 the Polar Eskimo passed from a primitive bow-and-arrow stage, self-supporting and without contact even with other Eskimo, to a modern hunting and trapping type dependent on the rifle and therefore on trading.

A new economic life began, but fortunately Knud Rasmussen was at hand to direct and control the change, and to supply a further chapter in their history. Rasmussen's first meeting with these people was in 1903; he thus overlapped Peary, and in 1907 he was in Ellesmere Land with two of their hunters, who went with him for a 1250-mile sledge journey at a few hours' notice. Finally, in 1910, he founded an Arctic station at North Star Bay—the Thule station—as a base for exploration and for trade. In this way the Polar Eskimo, who are the only pure-bred Eskimo in West Greenland, were controlled by Rasmussen till his death in 1933, and in the best sense preserved, and the critical period which would have followed Peary's gift of rifles passed. Rasmussen has himself described them and their folk-lore in his writings and books, and recently a more dramatic picture has come from his friend and



The Tower, Middle Island, Cary Islands

Turnstone Beach, Buchanan Bay

helper, Peter Freuchen, who has written about this Golden Age of the Polar Eskimo in 'Arctic adventure.' After Rasmussen's death the fate of these people was once more in the balance, but after some delay and negotiation the Cape York district has now been finally taken over by the Greenland Administration.

Buchanan Bay and Bache Peninsula

From an early date our plans had included the investigation of abandoned Eskimo sites reported by various travellers on Ellesmere Land, and more particularly we had in mind to visit Buchanan Bay between Cape Sabine, where Smith Sound is at its narrowest, and Bache Peninsula. It is generally believed that this region is on the main route by which the Eskimo originally reached Greenland, but at what date and by what stages remains in doubt, and on this account archaeologists interested in Eskimo origins have for many years wished to visit Buchanan Bay. A successful investigation by digging must be made when the ground is least frozen and is therefore of necessity limited to the summer months, although a crossing of Smith Sound is much easier by sledging in winter. Such a summer visit demands both favourable ice conditions and a ship suitable for ice-navigation, and also a captain willing to take risks.

From Robertson Bay we proceeded by night up the coast past Cape Alexander and the Crystal Palace cliffs and spent the next day, August 16, in Pandora Harbour, a little to the south of Etah. The name dates from Sir Allen Young's visit in 1876, when a chart was made in view of its possibilities as a winter harbour. An older name, for the outer portion at any rate, is McCormick Bight, given by Hayes in 1860. Historically, interest in this neighbourhood begins with Inglefield's great voyage in 1852, when he made the first entry into Smith Sound, and gave the name Crystal Palace cliffs to the striking superimposed horizontal features north of Cape Alexander, where the rock terraces rise one above the other like balconies. The cliffs are high, and Pandora Harbour has at first an appearance of snugness, but this is largely offset by a certain gloom. It is moreover open to west winds, and was not in our view either sufficiently attractive or secure to be a good winter harbour. From the high hills above we looked across Smith Sound, and it was evident that we could cross to Cape Sabine without ice hindrance. The crossing was made that same night, through small scattered floes, and in the early hours of the 17th we had passed Cape Sabine, and were abreast of Camp Clay, where General Greely made his fatal camp in 1884. No attempt was made to land, and we proceeded past Cocked Hat Island and the north end of Rice Strait along the south side of Buchanan Bay to try and locate an Eskimo site discovered by Sverdrup in 1898. We had a copy of Sverdrup's chart with us, but we found some difficulty in identifying the map representation with features on the ground. An Eskimo village however was ultimately found with the remains of winter houses at a place which we ourselves have named Turnstone Beach, though there is now little doubt that this is the place to which Sverdrup fancifully referred as "Eskimopolis."

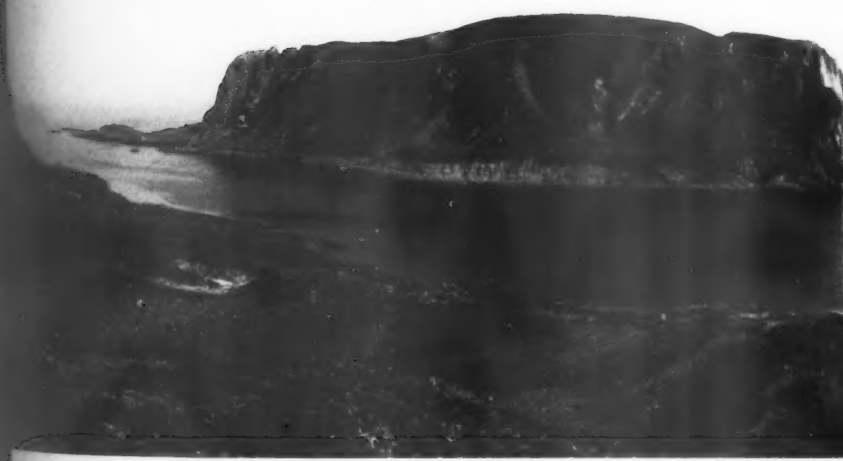
Our main investigations into Eskimo archaeology were made at Turnstone Beach, Lethbridge being in charge of the digging, aided by Paterson, Feachem,

llesmere Land coast, with the entrance
Rice Strait on the right

and Leaf. The length of time we should be able to stay was of course dependent on the ice conditions, and though these were at the outset favourable, a few hours might see a complete reversal of fortune. Lethbridge and his party were continuously at work on the 17th and 18th, and finally for a third day on the 19th. This was a piece of exceptional good fortune, for the weather was not very favourable, and an almost constant north-east wind not only made conditions chilly, but also should by rights have brought pack-ice into the bay. There were large floes in Kane Basin, and the right-hand drift component would therefore tend to bring them straight into Buchanan Bay, but the set of the tides appeared in some way to prevent this, or at least to keep the floes continually on the move, and in spite of the north wind the bay never became completely filled with ice.

On the third day we understood local conditions sufficiently well to feel justified in leaving Lethbridge's party at Turnstone Beach, while the ship crossed for a short visit to Bache Peninsula. Our objective was the farthest north post, now however abandoned, of the Royal Canadian Mounted Police, sited about 15 miles in along the north side of Buchanan Bay. Progress across the bay was slow as the Kane Basin floes were many miles in diameter, and a lengthy zigzagging process was necessary. At the same time we were uncertain of the position of the huts, and had to make a wide cast eastwards before nosing in along the south shore of Bache Peninsula towards Flagler Fjord. Moreover the chart, which is based on Sverdrup's made in 1898–99, needs considerable amendment. The post lies about 15 miles west of Cape Camperdown, and an indication that one is near is given by a large and high island, nameless and not marked on the chart. At this point we had to cut through a stretch of unmelted winter ice, worn thin and adrift, but sufficient to show that the open season at Bache is late even in a favourable ice year. Ships can pass inside the island, and the huts are in a small bay immediately beyond, though not visible till one is actually on them, for the post is in a sheltered corner, and if it were not for its remoteness and difficulty of access it would no doubt be still in permanent occupation. The huts were erected in 1926, and the post visited again the next year by the *Beothic*. Further visits by ship were prevented by adverse ice conditions till 1931, and supplies had generally to be left at Rice Strait. The Canadian authorities therefore decided to evacuate the two men at the post as soon as the search for Dr. Krüger, who had disappeared in 1930, was completed; this was to have taken place in 1932, but in that year no contact whatever was possible, and the relief ship *Nascopie* failed to penetrate either to Rice Strait or to Buchanan Bay, and the post was therefore evacuated by sledge journey to Craig Harbour in the spring of 1933. We made an inspection of the main hut, which is in very good order, and of the adjoining storehouse and workshop. The huts are painted a light green, and the orderly arrangement and neat lay-out gives the place a very attractive appearance. There are also two large motor boats and some smaller boats, but these are exposed to the weather and may not long remain in good condition. Our time was short and confined to a brief look round and to making certain that everything was secure. We also left some walrus meat for Haig-Thomas and Wright, who were due to arrive in the autumn, or at latest in the spring of 1938.

Bache Peninsula, Ellesmere Land, with Ca



Isbjörn Island, Cary Islands, seen

d, with Cape Camperdown on the right

lands, seen from Middle Island

High level plateau incised by the upper part of Tromsö Fjord

Lower Lethbridge Lake, Tromsö Fjord

Eagle Beach, Dexterity Harbour

Terraces at the head of Dexterity Fjord

Our main interest in visiting Bache was a geological one, as it was known that the Thule sandstone, a name originated by Dr. Lauge Koch, who is the pioneer in North West Greenland geology, is found on Bache Peninsula lying between the Archaean basement rocks and lower Palaeozoic beds. The first observations had been made on Sverdrup's expedition by Schei, who reported a red sandstone and Cambrian fossils lying loose, and he was succeeded by Bentham in 1935 who was the first to identify the red sandstone as the Thule sandstone. An almost perfect section of these various rocks occurs immediately behind the hut. The Archaean basement has been levelled off to a peneplain surface; above are found the beds of the Thule formation consisting of purple or chocolate-coloured grits at the base, yellow-white grits about 60–70 feet thick, and dolomites; these are then succeeded without apparent break by limestones in which Drever without much difficulty found Cambrian trilobites in place. This was a discovery of some moment, and it immediately narrowed the space in which an unconformity between the Thule sandstone and Cambrian beds might lie, and after a close examination of a practically clean section we decided that at Bache the Thule beds are merely the basement lower Cambrian and pass up conformably into Cambrian fossiliferous horizons. The view that the Thule sandstone is merely the Cambrian basement bed is not however in keeping with Dr. Koch's interpretation in North West Greenland, based on sections at Inglefield Land and at Brönlund Fjord, which may however be misleading.[1] If there is no unconformity other ideas must also be changed, and it means in particular that the dolerite intrusions round Smith Sound are not of pre-Cambrian date, and may be of any age. Dolerites do not actually crop out near Bache Post, but as seen from out at sea in Buchanan Bay they appeared to occur on the mountains to the east about half-way towards Cape Camperdown.

A further interest in the Thule sandstone was in comparing it with similar beds in East Greenland. In 1929 thick quartzites, pink and green in colour and with obvious ripple markings, were discovered on Petermann Peak. Later Koch regarded these as forming the lowest division of his Eleonoren Bay Series, and ultimately came to the conclusion also that the Petermann quartzite was the equivalent of the Thule sandstone. I think this view is probably correct, but the data for making a final decision are as yet insufficient. Koch's Thule sandstone thus becomes of greatly extended significance with a possible range from East Greenland far into Arctic Canada; in addition to the occurrence at Bache we found a wisp of it above Craig Harbour in Jones Sound, and there is also ground for believing that beds in the west part of North Devon Island marked as Old Red sandstone are perhaps outcrops of red or yellow Thule sandstone still farther to the south-west.[2]

Lethbridge's party at Turnstone Beach had practically completed their excavations after a three-days' dig. At the lowest levels much of the ground

[1] *Cf.* Koch, *Meddelelser om Grönland*, vol. 73, p. 23, and 'Geologie von Grönland, pp. 10, 24, 25, etc.

[2] Reference may also be made to a red sandstone overlying gneiss at Cape Warrender on the south side of North Devon Island, and to a similar rock at Cape Bunny at the mouth of Peel Sound, as described by Haughton in the Geology Appendix to McClintock's 'Voyage of the *Fox*.'

was frozen; further results would only come very slowly, and hardly justified longer delay. On August 20 we moved away from Buchanan Bay southwards through Rice Strait. Landings were made at several points, and an inspection was also made of the R.C.M.P. hut at Fram Harbour. This hut, styled Kane Basin Detachment, was erected in 1924 at Sverdrup's 1898–99 winter quarters, and stocked with provisions; it has never so far as I know been lived in, and is small and not very strongly constructed or weather proof. The food stores appeared intact, but musty, and considering their age they are now no longer reliable.

Leaving the south end of Rice Strait we proceeded down the Ellesmere Land coast. North-easterly winds had prevailed during our stay in Buchanan Bay, and the open conditions experienced in Smith Sound on August 16 were now replaced by something less easy. Off Baird Inlet we found ourselves behind close ice and finally had to butt our way eastwards to get clear. The floes however were light and appeared to be broken-up winter-ice formed in Kane Basin rather than polar floes of greater age and farther origin. The individual floes were small, but fairly tightly packed, and it gave an opportunity for the *Isbjörn* to prove her qualities as an ice ship, by quick manoeuvring, elbowing and nosing through the pack. This move took us away from the Ellesmere coast and some way across Smith Sound towards Cape Alexander, and any attempt to make further landings on Ellesmere Land or to identify the rock formations ashore had to be given up. As it was we had considerable difficulty in checking the various features such as capes and inlets shown on the charts. This was not due merely to our distance from land. There was a fine view into Baird Inlet and up a great glacier corridor at its south-west head. We failed to identify Cape Faraday, and the chart of the coast south of Rice Strait obviously requires considerable correction not only in small detail but also in the larger features. Early on the 21st we were no longer sheltered by scattered ice-floes and became exposed to a strong north-east swell, and after five days of northerly winds there was a close belt of ice all the way down the Ellesmere shore, and no obvious break in it till we came abreast of Jones Sound. We passed through Glacier Strait, but by then the ice was no more than a narrow stream of brash along the shore, and we reached Craig Harbour without difficulty early on August 22.

Jones Sound

Our plans did not include any long stay in Jones Sound, and our visit was primarily in order that we should make ourselves known at the Royal Canadian Mounted Police post at Craig Harbour, which, since the evacuation of Bache, is now the most northerly official station in Canada. The detachment consisted of Corporal Hamilton and Private McWhirter, and they had had with them as visitor for the winter Robert Bentham who was making geological and topographical maps of southern Ellesmere Land. Jones Sound however was clear of ice, and the intention of staying only a few hours was reconsidered. Paterson was left at the post with Corporal Hamilton to study the two Eskimo families from Ponds Inlet, who were with the Police, and we in exchange took on board McWhirter and Bentham and crossed in the night to the south side of the Sound, to Cape Sparbo, or to give it its older name, Cape Hardy.

We anchored about half a mile east of the cape, but cannot recommend the anchorage, as the ground is shallow and boulder strewn, and it is not much more than an open roadstead. Lethbridge immediately located a compact village of old winter houses close under the cape itself; digging was begun, and two complete days were spent on this work.

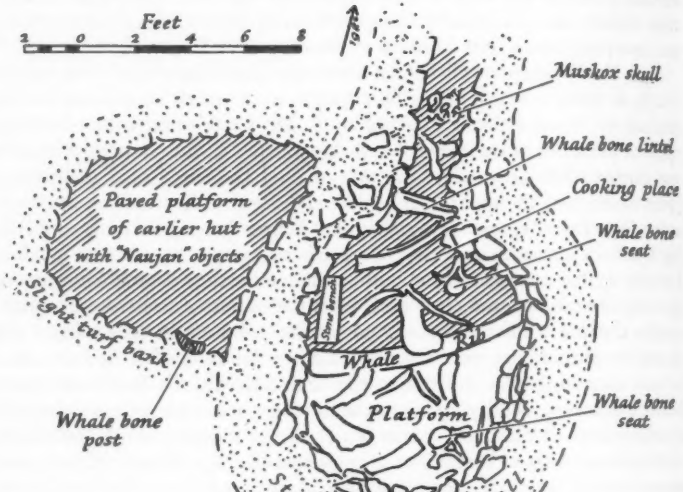
Cape Hardy sticks out prominently from the coast, and there is no doubt of its being the point so named after an "old mess-mate and chum" by Inglefield in 1852. The later name Sparbo first appeared on Sverdrup's map, having no doubt been given in ignorance of the older name. The cape is of double nature, consisting of two 900-foot hills separated by a small bay, and the two joined to the mainland by superficial deposits. Both these hills are table topped, and are outliers from the hills of the mainland, and probably the same peneplain is found here as at the Cary Islands.

Cape Hardy became well-known under the name Cape Sparbo in 1909 on Dr. F. A. Cook's return from the expedition on which he claimed to have reached the North Pole on 21 April 1908. Dr. Cook's first winter had been spent at Etah, but at the end of his sledge journey in the summer of 1908 he was carried south down the west side of Axel Heiberg Island and reached Jones Sound from the west; arriving late in the season, he was forced to winter at the Cape from September 1908 till late February 1909. To any one reading Dr. Cook's narrative the site of his winter camp is not at once obvious, but any doubts are cleared up if the account is studied after knowing the ground, when it becomes clear both from the narrative and from his photographs that his winter quarters were at the point itself. Apart from this, several modern articles were found by Lethbridge in one of the huts which he was excavating. We did not at the time have Cook's book with us on board, and before identifying his hut at the Cape spent some time looking for it eastwards along the coast. Some ten or twelve musk-ox skulls were found scattered over a small area about 3 miles east of Cape Hardy where a small stream enters Glacier Bay, at a place where the ground is much broken up with boulders and where there is a steepish ramp of moraine material. Heads alone were found, and showed that the animals had been killed not for sport but for food, and the quarters only removed, and there seems little doubt that they date from Dr. Cook's enforced wintering. Dr. Cook's hut proved to be more or less an Eskimo winter house, with walls built up to form a fairly comfortable shelter, with whale-bone rafters, which have probably been covered with skins, and standing, as Cook says, halfway across a still older Eskimo house. We found some hard wood and canvas, several rifle cartridge cases, parts of an American drill, knives, steel files, shell trouser buttons, cord, objects made of oak, tin cans with screw necks, etc., but no papers or other documents.

Musk oxen were very common both east and west of the Cape. We counted up to at least eighty head in a 3-mile radius, and the total number in the area is no doubt considerably in excess of this figure. The pasture ground is good, in a region of raised beaches with occasional shallow lakes; both ground and weather seemed much more moist and humid than in East Greenland, and one had to revise the usual view that musk oxen require a particularly dry climate. As elsewhere in Canada musk oxen are under strict Government protection.

North East Baffin Land

We returned to Craig Harbour to exchange personnel, left late on August 25, and next day passed the mouth of Lancaster Sound. Some scattered pack-ice was seen during the night off the north-east corner of North Devon Island, indicating that the south end of the Ellesmere Land ice, which we had rounded through Glacier Strait three days previously to reach Craig Harbour, had by now drifted farther south across Jones Sound, though not as a close ice stream. Lancaster Sound was entirely free of ice. Reluctantly I had to decide that time did not permit us to undertake an extended journey into the Sound. We had plenty of oil, and for an open year the season was not too



Dr. F. A. Cook's winter quarters at Cape Hardy

late; but the deciding factor was the necessity of making one further balloon flight with Dymond's apparatus, and the knowledge that this was best done by returning to Godhavn. We reckoned however that we would have time for a short reconnaissance in North East Baffin Land. We planned to try and fix Coutts Inlet (see folding-map following p. 480) more definitely, and also to locate a second fjord reported about 20 miles farther south, and known to Eskimo as Anaularealing. The coast of North East Baffin Land as set down on the Admiralty Chart is that drawn by Sir John Ross in 1818 and the names are those given by Ross, except for two, Dexterity Harbour and Maud Harbour, given by British whalers in the nineteenth century when this coast was visited regularly each year by sailing ships, and later by steam-whalers from Dundee and elsewhere. Sir John Ross's chart was of course suspect, as it was made from some distance out at sea, and we attached more impor-

tance to a pencil sketch of the coast given to us shortly before we sailed by Captain Adams. A long fjord behind Dexterity Harbour was thought to be Anaularealing; but apart from this there was enough on Adams's sketch to show that considerable changes in the coast-line as shown on the Admiralty chart were certain.

Early on the 27th we were off the land at Cape McCulloch, where the coast, as far as limited visibility showed, makes a sharp change in direction. There has been confusion between this point and Cape Bowen, and in whaling diaries the names are interchangeable, though Ross made them quite distinct. From our landfall we steamed south-east to the mouth of Coutts Inlet, of which there can be no doubt, as Ross has a drawing of its 3-mile-wide mouth, with Cape Antrobus on the south and the prominent headland which he named Cape Coutts on the north. By log Cape Coutts was 14 miles from our landfall at Cape McCulloch, and this is in keeping with Ross's figure of 13′ difference in latitude. The coast between the two is fairly regular, with a sandy beach, and it is probably an outwash plain, as two large glaciers could be seen about midway ending inland some 3 miles from the coast. The log reading fixed Cape McCulloch as our landfall of the morning; unfortunately there was some mist and rain at the time, and we could not be certain of any features farther to the north-west, where Cape Bowen must lie; it was mapped from a distance by Ross, and may of course be not a real cape but only a slight bevel on the coast. It should be emphasized that Ross was some way out at sea; his sounding of 120 fathoms on September 5 was made, according to his reckoning, 17 miles north-east of Cape McCulloch, and he was even farther out from Cape Coutts on the two following days, and was never close to land till abreast of Cape Adair.

By midday we were steaming up Coutts Inlet. Cape Antrobus on the left was then seen to be on a large island. Some 12 miles in there is a branch fjord to the north, which we did not enter; holding straight on we passed along a narrow fjord with steep walls rising to pinnacle peaks 2000–3000 feet in height. It was misty on the tops, but the clouds came and went, revealing striking clefts and joint faces, and in particular a precipitous overhang. We were to see many more of these characteristic features in succeeding days, features which closely paralleled the mountain forms seen at Eglinton Fjord in 1934. About 6 miles from the head of Coutts Inlet a change in the scenery began: glaciers were less frequent, the mountain heights lower, and gentler slopes became the rule. We had in fact passed through canyon country to a region of more gentle relief. The fjord ended 42 miles from Cape Coutts where a side glacier juts across from the north side. Marine terraces were prominent in the foreground, and beyond the glacier is a lake, about 2 miles in length. Parties went ashore, and three old Eskimo winter houses and some tent rings were examined, and reported on by Lethbridge as having probably been occupied comparatively recently, some of them within the last few years.

Our plans for Baffin Land had now taken definite shape. We had decided to make a running survey of the coast from Cape McCulloch to Cape Adair, the work being done by sextant methods from the ship under Paterson's direction; this we anticipated would take about six days. On the 28th therefore the ship returned to Cape Coutts, circled round the two large islands which

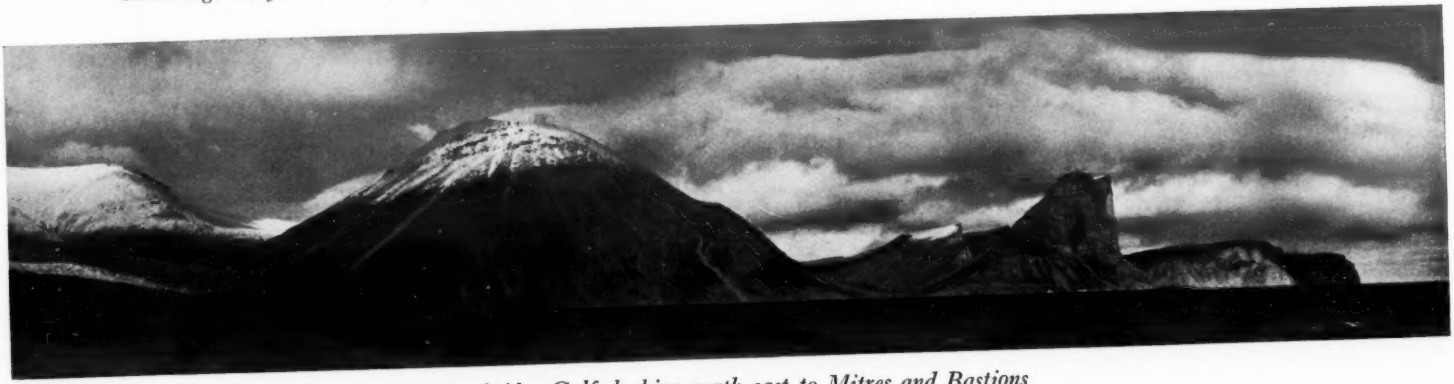
lie at the mouth of the Inlet, and in the afternoon steamed south past a low point. From there we headed towards Cape Adair with the intention of locating Dexterity Harbour as early as possible and making sure of this once well-known anchorage. In this way we planned to fix the south-eastern limit of the map, and then work back to Coutts Inlet by a zigzag course closer inshore. The problem up till now had appeared simple and we had no doubt that "Anaularealing" would be as easily found as Coutts Inlet. The two islands mentioned were readily identified as those known to Dundee whalers as Nova Zembla Island and Round Island, and they had in fact been clearly drawn in on Captain Adams's pencil sketch. The low point to the south is the Ragged Point of the whalers, and its position is not far from Ross's Cape Jameson. Ross however must have named a mountain as Cape Jameson, as the actual cape is low and certainly not visible from Ross's position. I therefore prefer the whalers' name which was in use for at least two generations and is descriptive. Ragged Point, except to ships close in, is inconspicuous in comparison with Cape Coutts and Cape Antrobus; it is a low black cliff about 100 feet in height sloping gently inland, and fronted by red hump-backed skerries not much above sea-level.

South of the Point was an outwash region, and then a great gulf opened to the west, bounded on the north by magnificent steep cliffs, appearing almost vertical; several fjord openings were possible, and it was evident that the survey would be more complicated than was at first thought. We held on across the mouth of the gulf and at dusk passed the entrance to Maud Harbour, easily recognized from Adams's sketch by a characteristic group of three glaciers on the north face of the promontory and by a single big glacier reaching sea-level at the mouth of the harbour itself. The ship then continued on a south-easterly course across the mouth of a second large gulf and past a prominent headland 1500 feet in height. Two hours beyond Maud Harbour we were off an opening which in the dark we judged should be Dexterity Harbour, and turning sharp right we crept in slowly for about 6 miles and came to anchor.

Daylight showed that we were near the west point of a large island, on which about 1 mile to the west was a small basin which we called Lemming Harbour. From there we looked into the second gulf from its south side, and numerous openings lay to the west. Further, we were certainly not at Dexterity Harbour; the surroundings disagreed with the description given by Adams, who had emphasized the bar across the harbour mouth, and the mountain shapes could not be reconciled with those given in a photograph which we had found in Peary's 'Northward over the Great Ice.' [1] This was our first check to an easy unravelling of the coastline, but the problem on this particular day was solved when in the afternoon we sailed south down the west side of a second island and turned left into a strait leading to the open sea with a protecting bar. We dropped anchor off a wreckage-strewn beach, further proof that we were at Dexterity Harbour, the wreckage being that of the *Eagle*, driven on shore in a gale in 1893. The harbour itself is really a strait about 2 miles in breadth, and whaling ships were accustomed to anchor either on the east or west

[1] Peary made two visits, first as a passenger in the *Eagle* in September 1886, when he was weatherbound at Dexterity Harbour for nine days in an almost continuous snowstorm, and secondly in the *Kite* in 1895.

Cambridge Gulf. To the left of Livingstone Island is the entrance to Glen Roy Fjord; to the right lies Quernbiter Fjord



Cambridge Gulf, looking north-east to Mitres and Bastions

side according to the wind, but preferably on the east side, where an Eskimo village grew up during the 'nineties. The captain and Robin took soundings across the bar and mapped the outer coastline by motor boat. On the west they reached Robin Point, which rises steeply inland, whereas the cape marking the east entrance to the harbour is low and widely rounded, being the seaward scarp of an outwash slope some 3–4 miles in depth, at the back of which the mountains rise to heights of about 2000 feet.

Captain Adams had told us that there was a long fjord running in behind Dexterity Harbour, marked at its entrance by a small islet on the starboard hand, and as first seen by him was described as a "regular hole in the wall." We spent August 30 in this fjord, and named it Dexterity Fjord, as this was apparently the whalers' name, when they came, as they frequently did, for caribou hunts. In its outer part the side walls consist of magnificent cliffs 2000 feet high, on which joint faces, scaling off like the successive coats of an onion, are prominent. Gandolf Head was conspicuous in this respect. A sharp right-hand turn is followed by an equally sharp turn to the left, but beyond the zigzag the scenery changes from a confined fjord to a region of wide open valleys rising to gentler mountains, resembling country round the Sound of Mull; we named a bay on the left Duart Bay on this account. No caribou were seen, but it appeared a very likely grazing ground. Thereafter the fjord sides closed again and remained steep as far as the head, where we anchored, 40 miles in from Dexterity Harbour. The fjord head is marked by conspicuous terraces. Next day we retraced our steps and navigated throughout the day counter-clockwise round a large irregular-shaped island, which I propose to call after Captain Adams, and then feeling our way through the stranded bergs on the bar at the south end we doubled back to anchor overnight at Duart Bay. This is almost immediately opposite a small bay on Adams Island where Adams himself anchored in the *Diana* in 1903, and he has since told me that he painted a white anchor on a large boulder on the beach, where it probably still remains. There are several Eskimo winter houses at Duart Bay including some older ones of "Naujan" date, but four at least were modern and had apparently been occupied very recently; these huts had had doors and the roof had been of sealskin over a wood and bone framework. A small river enters near by, but we saw no fish ponds.

September 1 was the first reasonably clear day since we had been on the coast. Up till now there had been fog and mist on the mountains, but fortunately no strong winds. There was continuous bright sun for the first time as we entered the inner part of the large gulf south of Maud Harbour and steamed up to anchor at the head of a second fjord. A high moraine terrace marks the end, and beyond a short stretch of river leads up to the Lower Lethbridge Lake, one of two, each about 2 miles in length. Next day we remained at anchor, and various parties were out on the hills, whilst the others spent the day fishing in the lower lake. We propose to call this second fjord Tromsö Fjord after the home town of the ship and crew. Eskimo remains at the fjord head were scanty, not more than a few old tent rings being seen; but about 2 miles down on the west side were signs of several modern tents and of fairly recent occupation. The hilltops for the most part were boulder-covered and of plateau form, and from this height high-level lakes were fre-

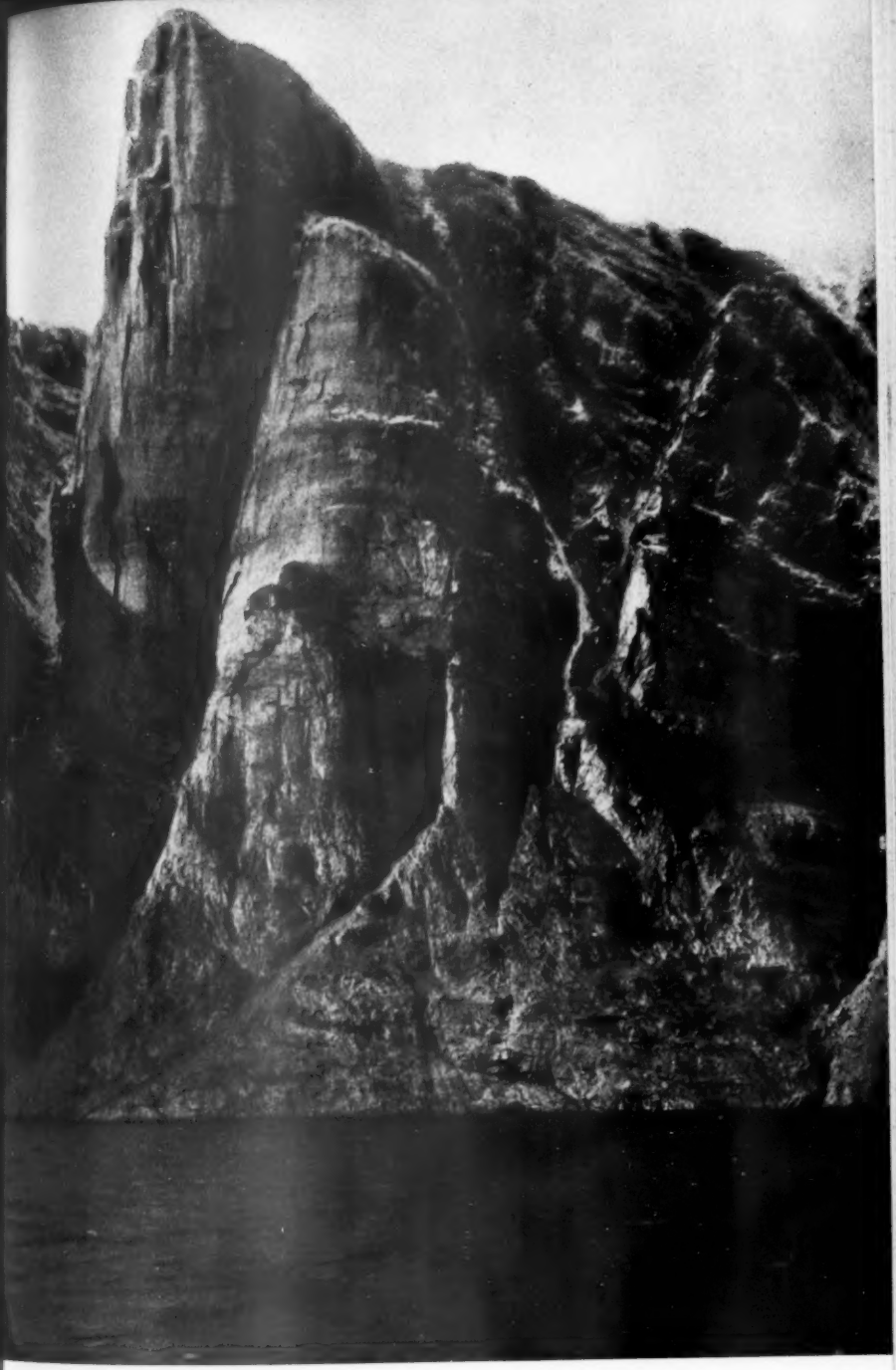
romsö Fjord

quently sighted. The way in which the narrow fjord cut into the upland is an interesting problem. As far as could be seen there was no ice-cap and all the mountain country to the west was ice-free.

We left Tromsö Fjord on the 3rd, and soon discovered a third fjord. This was long and straight, and with steep walls on which jointing was again prominent; it was dark and gloomy compared with those already visited, but in contrast as we steamed up was the sight of the sun shining on a snow-domed mountain far up the valley at the end, and as we neared the head we saw two strings of snow geese flying south-west, their white wings emphasized against the background of dark fjord wall. The river entering at the head was much the biggest seen and suggests a valley about 20 miles in length. There was very little in the way of Eskimo remains, but these perhaps occur in the neighbouring and more open Kentra Bay, which we had no time to enter. I have named this, the longest of the three fjords south of Maud Harbour, after the Royal Society; and of the three it is the only one which follows a direct line with steep cliffs almost throughout its length. The other two follow a more zigzag course, and this is explained by their being partly located in the more open moorland type of country. There was nothing however about the head region of any of these fjords which suggested an overland route to Foxe Basin, such as was reputed to be the case at "Anaularealing." The large river at the head of Royal Society Fjord suggests a long valley, but the absence of Eskimo remains is against its being a frequented through route, and in this respect our search so far was unsuccessful.

Leaf Bay was tried for a passage on the 4th, but found closed, and, knowing by then that Maud Harbour was not on an island as we had been led to believe, we took a course to round the headland on which the harbour is situated and so returned to the first big gulf seen in the afternoon on August 28. The distance from Maud Harbour to Ragged Point is about 25 miles, and this is the biggest and grandest of all the fjord approaches. Followed westward the gulf remains wide for about 20 miles, but the main axis continues as an almost straight cut, 2 miles broad, for another twenty. This is a region of almost vertical cliffs, the highest measured being the 2900-foot drop of the Executioner Cliffs. The fjord is dominated by straight features and vertical walls. Most of all it resembled Royal Society Fjord, but it was more exposed, the open sea to the north-east being in sight from the anchorage at the head; on both days that we were here strong winds blew down the fjord. At the head there are two rivers, neither of any great size; we followed up the larger and northern one for a few miles, but it lay off the line of the fjord and is not likely to have its source more than a short distance inland. There are a couple of old winter houses at the fjord head, and occasional caribou tracks were noticed, but there was no sign of the place having been recently frequented by Eskimo.

This fjord impressed us very differently from all the others. As it was in the straight line from the open sea we had hoped it might be the Eskimo route across Baffin Land. More than any other it gave the impression that the rocks had been cut through, and we have therefore named it Quernbiter Fjord after King Haakon's sword, given him by Athelstan, with which he is said to have slashed through a millstone to its core.



Cliffs near the entrance to Icy Arm, Cambridge Gulf

Terraces at Keel Bay, Glen Roy Fjord

Dr. F. A. Cook's winter quarters at Cape Hardy, Jones Sound

We returned down Quernbiter Fjord on September 5, a short detour being made into a berg-strewn branch on the north side. A large valley glacier about half a mile in width enters at the head; and it was much the largest glacier seen. An unusual sight was a tributary glacier from the south cascading across the surface of the larger one. This was the only place where a fjord head ended in a valley-wide glacier face.

There remained as we thought only one more unentered fjord, namely, that behind Livingstone Island, but about 12 miles west of its entrance this in its turn divided. We chose the right-hand fork, and Rannoch Arm, as we called it, proved very mild and gentle compared with the closely adjoining Quernbiter Fjord, a contrast that was brought out by the autumn colouring of the vegetation on this sunny day, whereas the other had been almost lifeless, with steep grey walls. The sweep of the hill slopes round Rannoch Arm was comparable with Duart Bay and Kentra Bay. It was not one of the longer fjords however and it narrowed about 6 miles from the mouth, opening beyond into a basin about 3 miles in length. There were modern tent rings but no huts at the fjord head, though some with standing roof frames were sighted at the narrows. The entering river is small, and the farthest that we saw from heights at the head was a snow-covered ridge about 10 miles distant, beyond which, to judge by the evening sun, lay open country away to the south-west.

This completed the tenth day spent in the fjords. We had by now exceeded by many days our original time allowance. September 6 had therefore to be the last day, and a short stop only was planned for the following forenoon, while passing Maud Harbour, for the chance of an astronomical fix on the outer coast and long rays to tie the map. We had been fortunate in almost every way during these ten days, and had been able to move freely with the ship wherever we wanted. Our only hindrance had been mist and fog, more especially during the first few days, but mist conditions are probably the rule rather than the exception in North East Baffin Land at this time of year, and the 1934 visit to Eglinton Fjord had suffered even worse in this respect. Clouds on the hills did not of course interfere with the survey of the coast, but there was the serious drawback that astronomical observations for position were seldom possible, and, if it had not been for two nights at Rannoch Arm and Tromsö Fjord which were sufficiently clear for star sights, we should have been without any accurately fixed positions.

We left Rannoch Arm with the first daylight, and passing Omega Bay (where we later spent the night) and Airds Point, turned sharp right and ran straight for a further 15 miles. No further branches appeared, and this proved the last and longest of the fjords, and also of different type from the others. These had been of two kinds or of a combination of the two, characterized either by straight precipice walls with onion jointing as in Royal Society Fjord and in Quernbiter Fjord, or by gentler vegetated slopes as in Duart Bay. The final leg of the last fjord, though forming a long straight reach, was not of the precipitous type, but on the other hand the slopes at the beginning were steeper than in the gentler parts of Dexterity Fjord, and they were often of bare rock, smoothed by glacier action. In the last 10 miles terraces were frequent, and these were not confined to low levels as were the terraces

found at almost all the fjord heads, but could be seen as high up as 800 feet, and at one place on the west side a terrace was observed at a height thought to be as much as 1500 feet. The lower ones were later than the rock smoothing and contained marine shells; but we did not think a marine origin was sufficient to explain all the terraces. We formed the view that in this part there had probably been a short period of glaciation, followed by absence of ice in the upper reach, and that the latter was dammed at its mouth by a glacier to form a lake of quiet water, where terraces had formed like those at Glen Roy in the west of Scotland.

We reached the head about midday, turned right into a small pocket, and quite unexpectedly found a deserted but quite modern whale-boat pulled a little way up the beach. We had always hoped that we might find Baffin Land natives in one of the fjords, and tent rings and winter houses with signs of fairly recent occupation had all helped to encourage us in the belief of there being at least one place still visited by the Eskimo. We had now before us at Keel Bay a modern whale-boat with sail and oars, but the owners themselves were away, no doubt caribou hunting. This fjord, if any, must be the evasive "Anaularealing." Dr. Therkel Mathiassen tells me that he heard of it from several Eskimo when he was at Iglulik and Ponds Inlet in 1922–23, and according to them it is the eastern end of a route across Baffin Land ending in the west at Isortoq on Foxe Basin.[1] A large river entered the bay, and its lower reaches seen over a distance of about 6 miles would be described in Scotland as a "strath"; it was wide like the valley of the Tay at Dunkeld, and similarly terraced for many miles up its course, and the faint yellow colour of the fading vegetation on the terraces combined with the darker colouring of the higher slopes to give this valley an attraction absent from all the bolder and grimmer fjord heads. This we felt must be the way inland.

We anchored that night at Omega Bay, where there are some huts of the whaler period, and at daylight on the 7th steamed away to Maud Harbour.[2] It was overcast and the day grew worse, and, by the time we reached Maud Harbour, some five hours later, it was half snowing, half raining, and sun observations were out of the question. Our luck had failed at last; we could not spare even one more day, and reluctantly we left in the afternoon in order to log the distance down to Cape Adair, and then square away across Baffin Bay to Godhavn.

Paterson's survey of the fjords was now complete, and our only regret was the paucity of astronomical positions. The survey programme had of course been an afterthought and had displaced the original idea of a short journey into the interior, but we were forced into making a survey as soon as we realized the exceptional nature of our discoveries in this unusually

[1] Therkel Mathiassen: Contributions to the geography of Baffin Land and Melville Peninsula. Report of the Fifth Thule Expedition 1921–24, vol. I, No. 3, p. 68. The name was first used by Boas in *Petermann's Mitteilungen*, Erganzungsheft 80, 1885, and 6th Annual Report, Bureau of Ethnology, Washington, 1888.

[2] The harbour takes its name from the whaler *Maud*, crushed by the ice in 1892; according to Adams she was lost in Maud Harbour, but if this had been the case we would almost certainly have found some wreckage. Captain Milne who was her captain at the time describes her as lost in "Milne Harbour", and his logbook suggests a place near the mouth of Coutts Inlet.

ice-free year. It was evident that with the short time available plane-tabling and accurate triangulation were out of the question, and that a running survey by sextant and range-finder was alone possible. I owe the idea of this speedier method to Paterson; we formed into groups taking turns at the work, and in this way no hour was lost so long as there was daylight. All helped, but I should specially like to mention Robin's assistance and the captain's co-operation. The length of coastline surveyed in the twelve days comes to a total of over 600 miles and the resulting map is a true picture of the fjord complex, being most accurate at Paterson Inlet, and least so in the early days of the survey. We have pinned the map to star fixes at the head of Tromsö Fjord and Rannoch Arm, both carefully determined by Carmichael and Robin. A position of similar accuracy on the outer coast would have been a useful check, but would not, I think, materially alter the outline resulting from the traverse methods, which must be regarded as an achievement in the short time available.

Conclusion

Godhavn was reached for the second time on September 10 in cloudy and unsettled weather; and a short visit was made to the Kronprins Islands (Whalefish Islands) on the 11th in case there should be a good anchorage in this more sea-surrounded group, but we decided that it was best to retain Godhavn as our base. The 12th was a blustery day with strong east wind, and snow lying down to the water's edge. The 13th was better; the rain took off and there was a sunny afternoon followed by a clear evening. The 14th therefore seemed the only chance for a flight, and the conditions at ground-level appeared almost perfect, but unfortunately the pilot balloon indicated a strong westerly wind at higher levels. Dymond's apparatus was launched soon after local noon, and followed eastward to bursting point at a distance of over 40 miles at a height of 16 miles. This final flight was of value in relation to Dymond's earlier ones, and confirmed what till then had been doubtful. The season was now at an end, as we had reluctantly realized ever since our return to Godhavn, and to have made this last flight was exceptionally fortunate; as soon as it was over we packed up and prepared for the homeward voyage.

We left late on September 15, but head winds held us back and it was not till we were past Cape Farewell on the 21st and some way beyond that wind and sea became favourable, driving us eastward. In these first days a most interesting feature was the autumn migration of waders and other birds as we went south in Davis Strait. Lethbridge made many notes, recording for instance flocks of grey phalaropes and turnstones settled on the water near the ship. Land birds, such as the Baltimore oriole, also lighted on the deck from time to time. It appeared as if the migration was of American birds in the main, but as waders were still noticed on the first day east of Cape Farewell, some part must also be directed towards Europe. Thereafter stormy seas made observations difficult compared with what could be seen in the oily swell off the West Greenland coast. The passage from Cape Farewell to Cape Wrath took eight days, and the expedition ended with our arrival by early morning tide at Leith on October 1.

APPENDIX I: COSMIC RAY AND METEOROLOGICAL WORK

H. CARMICHAEL and E. G. DYMOND

An unusually large amount of balloon apparatus and instruments was carried by the expedition in case recovery after flights was difficult and also to keep the expedition occupied if it should be delayed by pack-ice for a long period.

We had the following items of apparatus:

(*a*) Five sets of triple-coincidence Geiger-Muller counters with wireless transmitters on the lines of the meteorological "radio-sonde" for measuring the vertically directed cosmic radiation. A receiving station was set up in one of the deck cabins of the *Isbjörn*, and recovery of this type of apparatus was unnecessary. It was designed by Dymond and Mr. J. A. Ratcliffe, and was provided by Professor Barkla of the Physics Department of the University of Edinburgh.

(*b*) Ten sets of ionization chambers in which the intensity of the cosmic radiation, the air pressure, and the temperature of the apparatus were recorded on a moving photographic film. This apparatus, which had to be recovered, was designed by Carmichael and provided by the late Lord Rutherford at the Cavendish Laboratory, Cambridge.

(*c*) Four sets of Paneth air-sampling apparatus complete with Dines meteorographs and the necessary balloons supplied by the Air Ministry, Upper Air Section, Kew Observatory, through the kindness of Sir George Simpson.

There was unfortunately no opportunity to make flights with these sets, which is the more to be regretted as the staff at Kew Observatory had specially adapted them for use in the Arctic.

(*d*) Two Bosch meteorographs for recording upper air temperatures.

(*e*) Rubber balloons of 8 and 6 kg. weight supplied by the University Physics Department, Edinburgh, and by the Carnegie Trust for the Universities of Scotland.

(*f*) Rubber balloons of 350 g. weight for use as high altitude pilot balloons; provided by the Cavendish Laboratory, Cambridge.

(*g*) Hydrogen in 45 cylinders of 200 cubic feet each presented to the expedition by Dr. J. Donald Pollock.

For measuring the height and distance of the balloons in the air the following instruments were available :

(*a*) Two Watts $3\frac{1}{4}$-inch survey theodolites lent by the Royal Geographical Society.

(*b*) Two balloon theodolites reading to 0·1 degree, one lent by Mr. C. J. P. Cave and the other by the Air Ministry.

(*c*) Two $2\frac{3}{4}$-inch astronomical telescopes lent by the Master and Fellows of St. John's College, Cambridge. These were provided by the Cavendish Laboratory with more robust mountings and eye-piece scales.

Two instruments for measuring the sea-level intensity of the cosmic radiation were lent by their respective owners, namely, a Regener apparatus by Professor Regener, Stuttgart, and a Millikan-Neher apparatus by Professor Millikan, Pasadena.

The West Coast of Greenland is noted for calm weather both in summer and in winter; the weather is apt to be stormy only at the equinoxes. The summer of 1937 was no exception to the rule, but many of the still days were impossible for balloon work owing to persistent fog. Other calm days were unsuitable because the winds at high levels would have taken the apparatus too far over the land. Balloons with apparatus could not be launched from the

ship, and owing to the complete absence of pack-ice from which a launch might have been made, we were confined to the land and to islands near the coast. We had therefore to choose days when the risk of the apparatus going inland was slight. There were thus only three or four days in all really suitable for recovering apparatus.

Pilot balloons were flown on every possible occasion whether a flight with apparatus was being contemplated or not. On more than twenty of these flights heights of 20 km. were exceeded and in some cases 30 km. was reached. The balloons were given a free lift of 800 g. and the speed of ascent, which was checked on several occasions by simultaneous observations with the survey theodolites from both ends of a base about a mile in length, was 20·5 k.m. per hour. The greatest height thus directly determined was 30·0 km. The work was enormously facilitated by the clearness of the air, and the balloons, although their bursting diameter was only 14 feet, could be seen with the naked eye even at their greatest height.

The pilot balloon observations, which were made along the east side of Baffin Bay from Godhavn to Smith Sound from July 16 onwards, have shown a remarkable stillness of the air especially in the stratosphere. Strong winds when present were found between heights of 6 and 12 km. near the top of the troposphere, but never exceeding 70 km. per hour. Above 12 km. the average wind speed was only 16 km. per hour and individual winds there only once exceeded 30 km. per hour. The wind directions have not yet been fully worked out, but they were well distributed round the compass.

Balloons carrying apparatus were successfully released on six occasions. The well-tried methods of Professor Regener were followed, two balloons being used on each flight. The lower balloon was at a distance of 15 metres from the upper and was followed by a small reversible parachute and then by the apparatus, at distances of 30 and 55 metres below the top balloon. Such a tall outfit required careful releasing and we were greatly helped in this by the captain and crew, who also handled the heavy cylinders of hydrogen. As the balloons ascended they expanded and when sooner or later one of them burst the second checked the descent of the apparatus and by floating at a height of 15 metres above the sea served to mark its position. Ascent and descent each took about two hours.

This is probably the first occasion on which such elaborate free balloon flights with apparatus have been made in relatively uninhabited country. The arrangements for observing the balloons in the air and on landing were organized so as to give the greatest possible chance of success with the observing instruments available. On all the flights but one two observing stations about a mile apart were used each with a survey theodolite, a balloon theodolite and an astronomical telescope. The balloon theodolites were not accurate enough for base-line work, but their readings could be taken very rapidly and their chief purpose was to keep the balloons in view while the survey theodolites were being read. When the balloons were far away and while they were falling the astronomical telescopes also were used, readings of the length of the balloon string on the eye-piece scale enabling the distance to be estimated by subtense method. At elevations of more than 10° the balloons could usually be seen with the naked eye, even at distances of more than 60 km., looking yellowish-white against the blue of the sky.

The survey theodolites were usually operated by Drever and Robin, the balloon theodolites by Leaf, Paterson and Wordie, while Feachem and Lethbridge acted as timekeepers and recorders. This left Dymond and Hunter free to attend to the reception of signals on board the *Isbjörn* when the wireless

apparatus was being flown, while Carmichael first superintended the launching of the apparatus, and then used one of the astronomical telescopes.

A Bosch meteorograph which was carried on one of the cosmic ray flights on August 8 in lat. 77° N. gave a good record to a height of 19·5 km. Temperature in the troposphere fell to −51° C. at a height of 11·25 km. and then jumped up to −41° C. in less than 1 km., after which it rose gradually to −27° C. at 19·5 km. The heights deduced from temperature and pressure as indicated by the meteorograph agreed very well with the heights determined by theodolite and there seems to be little possibility of an error of more than a few degrees in temperature. A warm stratosphere in summer in polar latitudes has been suspected but does not appear to have hitherto been observed. Similar measurements made during the polar night would be very valuable.

Two of the flights with cosmic ray apparatus were specially successful, one with the wireless apparatus in magnetic latitude 88° and the other with the ionization apparatus in magnetic latitude 85°. The magnetic axis pole (lat. 78·5° N., long. 69° W.) is near Etah in North West Greenland and anywhere within 10° of the axis pole was equally suitable for the cosmic ray measurements which had been undertaken. The height reached by the ionization chamber apparatus (about 28 km., equivalent to a barometric pressure of only 12·5 mm. of mercury) was equal to the best that has been achieved anywhere with similar apparatus. The much heavier wireless apparatus reached 20 km. height.

Cosmic radiation in space chiefly consists of very fast moving electrons. These electrons, coming towards the earth from space, are influenced by the magnetic field of the earth to such an extent that only the fastest moving among them can reach the outer atmosphere at the equator. Thus in magnetic latitudes 3° N., 39° N., and 49° N., where high altitude measurements have been made, the maximum ionizing strength of the radiation increases as 1 : 2·45 : 3·32. The object of our cosmic ray experiments was to find if this increase continued to the magnetic pole where no visiting electrons from space can be turned away by the magnetic field of the earth.

It was found, rather unexpectedly, that the radiation near the magnetic axis pole as measured by both types of apparatus was not very much stronger than that at magnetic latitude 49° N. The maximum ionizing strength occurred at a height corresponding to a pressure of 20 mm. of mercury and was about 4·10 times that at the magnetic equator. This shows either that there are few relatively slow moving cosmic electrons in space or that there is some agency other than the magnetic field of the earth which prevents them reaching the earth. It is possible that this agency may be the magnetic field of the sun.

At sea-level the latitude variation of the cosmic radiation is much less marked, and the radiation is known with considerable certainty to be constant at higher magnetic latitudes than 50° N. and S. The sea-level Millikan-Neher apparatus was run on board continuously throughout the voyage to confirm this, while the Regener apparatus was run on shore at Godhavn and at Thule in sheds lent by the Danish Administration.

We have now completed our analysis of the cosmic ray and meteorological data, and the results will be published in due course in the Proceedings of the Royal Society.

APPENDIX II: ESKIMO ARCHAEOLOGY

T. C. Lethbridge

In 1934 T. T. Paterson began the excavation of a rectangular house site on the edge of a small bay on the eastern side of South Ryder Island, Melville Bay. The midden in front of this building had been almost entirely eroded away and

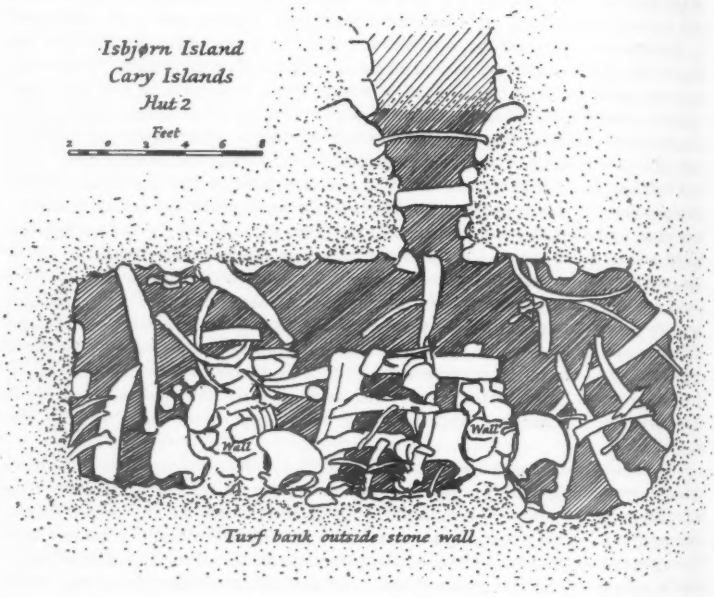
the house itself was threatened by the encroaching sea. We were able to complete the excavation with the exception of a second entrance which was covered by 2 feet 6 inches of filth and found to be full of ice. A very large quantity of objects was recovered belonging to a period earlier than the trading activities of the whalers on this coast. It is probable that the earliest objects are about five hundred years old.

Two village sites were examined on the Cary Islands, one on North West Island and the other on Isbjörn Island. In each place the village was situated on a raised beach with a southerly aspect and beneath precipitous cliffs which in one case were covered with nesting guillemots. Each site consisted of five long houses with umiak stands beside a convenient little bay. Clements Markham probably visited the one on North West Island. We excavated one of the smaller huts on Isbjörn Island and stripped the turf from the roof of a second to make a plan of its construction. Occupation, as estimated by the absence of middens outside the huts and the thin deposit on the floor of the one we cleared seems to have been of short duration. The roofs had been made with rafters of large whale ribs. The back half of the roof had been covered with a criss-cross mass of bones of whale, bear, and walrus with the great shoulder blades of whales at the corners. The front half had had a movable covering or at any rate had not had so permanent a structure. The back half had been turfed over. All the huts on Isbjörn had numerous bones of large whales in their construction while those on North West Island had few. It is suggested that the Eskimo on North West Island had moved to Isbjörn Island taking the bones with them. In any case the settlement on the latter was probably of short duration. It should be noted that model kayaks were found in the excavation and that kayaks had been unknown in the Thule district for very many years before they were reintroduced comparatively recently. Old as the settlement on the Cary Islands undoubtedly is there are traces there of dwellings of very much greater antiquity. Two hut sites were noticed which showed only as faint depressions and had completely merged into their surroundings. These are probably older than any others seen during the expedition.

A stay of three days was made in Buchanan Bay, Ellesmere Land, and we were able to survey and partially explore an extensive site on Turnstone Beach. This is probably Sverdrup's "Eskimopolis," although it is not by any means in the same position, his map being quite unreliable as to details along this bit of coast. There are numerous small beaches along Buchanan Bay, but Turnstone Beach was the only one where vegetation was at all in evidence. Here there was much rank grass and arctic willow. The place was about 100 yards wide and sloped gently to the sea. We originally plotted fifteen hut sites, but on closer investigation these were reduced to thirteen. We stripped the turf off all these with the idea that although the frozen ground would not thaw in time for us to excavate much of them on this visit, yet they would work much easier another season. Some of the more recent huts had been partly excavated already, probably by Sverdrup's party. Where however they had not been completely cleared, presumably on account of the frozen ground, we found a considerable number of objects. Some of the huts at Turnstone Beach are probably of great antiquity for they have merged completely into the surrounding landscape. Others however are not so old. It should be noted that one or two objects of the "Cape Dorset" culture were recovered and these from huts which would by no means appear to have been the oldest on the site. One small round hut had part of its whale shoulder-blade and rib roofing still in place, and several others had bones of large whales in their construction. It is probable that the economy of all the

Eskimo round Baffin Bay was considerably affected by the destruction of the Right Whale by the whalers, objects of baleen being very numerous at the Cary Islands, Turnstone Beach, and Cape Hardy on North Devon Island.

The Cape Hardy (Cape Sparbo) site was not unlike those on the Cary Islands, being situated on a grassy peat-covered raised beach beneath a considerable cliff, and with a small boat harbour in front of it. Nine huts were planned and all of them excavated. One of them was found to be the winter house occupied by Dr. Cook on his return from Axel Heiberg Island. Dr. Cook says that some of the huts are many feet beneath high-water mark; this is an exaggeration, but the sea has washed out three of them and it is probable that some degree of land settlement has taken place since these huts were occupied in "Naujan"



and "Cape Dorset" times.[1] The three washed-out huts and one other were of a round form with a domed internal entrance. The latter which was well preserved contained objects of the Naujan Culture only, but one of the washed-out ones produced a Cape Dorset harpoon. Flint implements of Cape Dorset type and little spatulate pendants belonging to the same culture were found mixed with Naujan objects in the other huts, which appeared from the vegetation to be rather older than the four just mentioned. These huts had external entrances and were larger and less regular in shape. The people who frequented Cape Hardy appear to have been less maritime than those who used the huts on the Cary Islands, Turnstone Beach, and South Ryder Island. Bones of caribou

[1] The term "Naujan" is preferred to the usual designation of "Thule." This culture was first fully explored at Naujan, and the use of the name Thule appears both erroneous and in view of its many other uses confusing.

were relatively as common as seal, while those of walrus were rare although the beasts are plentiful there now.

Numerous settlement sites were noted in North East Baffin Land. Those near the open sea as at Lemming Harbour, and Eagle Beach, Dexterity Harbour, are contemporary with the visits of whalers to this coast in the latter half of the nineteenth century. Farther up the fjords the huts are modern or, as at Keel Bay and Duart Bay, modern huts stand upon older sites. A hut was excavated at Duart Bay and produced a scanty Naujan occupation. Two others could be explored here. At Keel Bay a modern house stands also on a single Naujan hut. At Eagle beach, apart from three modern huts, a single hut was noted of considerable antiquity, but a stream running through it has destroyed its contents. It may be thought that before whaling times the Eskimo used the upper parts of the fjords for caribou hunting, that the presence of the whalers induced them to visit the coastal area, and that now they have returned to the old sites once more.

APPENDIX III: NOTE ON NAMES

J. M. WORDIE

Cary Islands

Previous to our visit map representations of the group have all been on a small scale and the only island to bear a separate name was Björling Island. We have therefore found it necessary to propose some new names for our sketch-map, and these have now been accepted by the Committee on Names in Greenland. The English and Danish equivalents are as follows:

North West Island	Nordvestø
Isbjørn Island	Isbjørnø
Middle Island	Mellemø
Fourth Island	Fireø
Table Island	Bordø
Dutch Hat	Hollaenderhatten
Bulls Eye	Tyreøjet
Dark Head	Sortehoved
Wreck Bay	Vragbugt
The Tower	Borgen
Markham Beach	Markham Strand

North East Baffin Land

The outline of the coast found on maps and charts is derived from the map made by Sir John Ross. On a much-reduced scale it forms the frontispiece to his 'Voyage to Baffin's Bay.' It was made from out at sea, and in the case of the coast between Cape McCulloch and Cape Adair it is based apparently on positions at sea between 5 and 9 September 1818. On the 6th the position as got by the sun in the forenoon is stated to be good, but that on the 5th was less certain; and Ross mentions how his distance as determined by the log disagreed. This is very likely considering that he was in a sailing ship and under the influence of a south-going current. It is quite natural therefore to expect errors in his latitudes and longitudes. The two points on his map which are readily identified on the ground are Coutts Inlet and Cape Adair. We passed the latter in the dark and were uncertain of our reckoning, but we are of opinion that Ross's position is quite possibly correct. At Coutts Inlet Ross made the latitude 72° N., whereas our survey makes it 72° 23′ N. This latter

figure however is based on a traverse from an astronomically fixed point in Rannoch Arm 70 miles distant, but even allowing for possible error on our part it is still evident that Ross's positions must all be treated as doubtful.

The whalers first visited the coast in 1817, or shortly afterwards. Ross was in company with whaling ships when he crossed Melville Bay at the end of July 1818, and two ships are known to have crossed in the previous season. The whalers appear to have done their best to use Ross's names, but this was by no means easy owing to the small scale of his published chart, and its sketchy nature. In practice the whalers used Cape McCulloch, Cape Coutts, Coutts Inlet, Cape Antrobus (though not always correctly) and Cape Adair, about which there is no doubt; they also at times used Cape Bowen, generally by mistake for Cape McCulloch, and occasionally Cape Jameson as an alternative to their own name of Ragged Point. Ross's other names, namely, Alticia Bay (which appears on his MS. chart but not in his book), Cape Cargenholm, Cape Hathorn, Cape Agnew, Bell Isle, Marianne Isle, Hamilton Bay, Cape McDouall, and Luce Bay are all doubtful. The whalers therefore used their own names, but these are actually few in number, and in some cases a captain would have his own individual name of which other captains were ignorant. Dexterity Harbour, for instance, is occasionally referred to as being in "Jamieson Inlet." A captain might also use a well-known name rather loosely, and Coutts Inlet is frequently used for the opening south of Round Island.

The whalers' names which can be identified with certainty are: Nova Zembla Island, Round Island, Ragged Point, Maud Harbour, Maud Head, Dexterity Island, Dexterity Harbour, and Dexterity Fjord. These names were found in Captain Adams's and Captain Milne's diaries, of which about forty have been read covering a period from 1883 to 1909. In addition certain other names are occasionally found in the diaries, but I have not as yet been able to identify them. One is Milne Harbour, where Captain Milne states that the *Maud* was wrecked in 1892; it appears to be near Coutts Inlet. Another is Bodega Harbour, which was probably near Ragged Point. Middle Island was probably the one which we call Bergesen Island.

All the other names on our map are new. North of Ragged Point the only new name is North Arm in Coutts Inlet. Between Ragged Point and Maud Harbour the following new names are proposed:

Cambridge Gulf
Bastions
Feachem Bay
Mitres
Icy Arm
Executioner
Quernbiter Fjord
Suilven
Livingstone Island
Glen Roy Fjord
Rannoch Arm
Omega Bay
Airds Point
Keel Bay
Drever Arm

Between Maud Head and Dexterity Harbour the following names are suggested:

Royal Society Fjord
Seal Bay
Leaf Bay
Samson Post
Kentra Bay
Pollock Head
Paterson Inlet
Dymond Islands
Stirks
Styrmann Islands
Tromsø Fjord
Lethbridge Lakes
Bergy Bar
Duart Bay
Gandolf Head
Adams Island

Ratcliffe Arm	Isbjörn Strait
Bergesen Island	Barkla Point
Lemming Harbour	Robin Point
Cape Carmichael	Cape Hunter
Cape Lord Rutherford	Eagle Beach

Like those in Cambridge Gulf they are all either descriptive or called after members of my party or those helping the expedition.

By adjusting Ross's map so that his Coutts Inlet position agrees with ours, his coastline can be made to fit in roughly with our mapping, but only approximately. His Hamilton Bay for instance is probably Dexterity Harbour; Bell Isle and Marianne Isle were mountain tops, the former probably on Bergesen Island; Cape Hathorn may have been Pollock Head; Cape Cargenholm is probably the big mass behind Maud Head, Alticia Bay somewhere in Cambridge Gulf, and Cape Jameson the high ground behind Ragged Point.

There is also difficulty in making a decision in regard to Eskimo names. Since my return I am indebted to Dr. Livingstone of the North West Territories Bureau at Ottawa for a report on a sledge journey which he made from Pangnirtung to Ponds Inlet in 1927. He was accompanied by a young Eskimo who, though not apparently himself familiar with the coast, had nevertheless learnt names from older hunters. One of their fjord names was "Annowegalook," meaning "the place where fish are killed with a stick," and another "Innellookjuen," meaning "an inlet shaped like the intestines of a seal." As there are so many fjords and branches it is uncertain to which these two names apply. In any case they are at variance with names supplied to Dr. Franz Boas in 1883–84, and it is surprising that the name "Anaularealing" was not familiar to Dr. Livingstone's Eskimo companion, as Boas had obtained the name from a native near Cape Kater. Other names which Boas puts on his map are Qiejiving for Coutts Inlet, Igping for an island at the mouth of Anaularealing and Tugdlirunirn for Cape Adair. In view of these uncertainties it seems hardly possible to do more than note the names, and hope that some correlation may be possible in the future.

There remains the question of whether any general name should be given to the region mapped last summer. Various names have at times been proposed, but all in turn seem to have faded. Sir John Ross used the name North Galloway for the region between Coutts Inlet and Cape Adair, but the name has never been adopted, and the same fate befell his other name of North Ayr for the coast from Cape Adair southwards. Ross also used the name Prince William Land for the coast north of Coutts Inlet, but in this case the name seems to have originated in a map-maker's error. The earliest use of Prince William Land which I can find is on Middleton's map published in 1743, though it is not clear whether he himself coined the name; if so it must be named after the third son of George II, usually known as the Duke of Cumberland. Middleton prints the name right across the land north of Repulse Bay, so that it includes the west of Baffin Bay south of Lancaster Sound, which at that date was wrongly placed in longitude owing to the little that was known about Baffin's voyage. Meantime Button's name of New Wales, given originally in 1613 to the west side of Hudson's Bay, was divided into New South Wales, and New North Wales, and the latter used by map-makers to include lands round Repulse Bay. Bowen therefore in his 'Complete system of geography,' published in 1747, mentions that Prince of Wales Land is the name given to land near Baffin Bay, and interposes New South Wales between it and Middleton's discoveries round Repulse Bay. It seems evident in spite of Bowen's use that Prince of Wales Land has

no claim to be used for any part of Baffin Land. Another possibility is Cockburn Land, a later form of Cockburn Island, Parry's name for the land immediately north of Fury and Hecla Strait. The name since then has migrated both to the north to Admiralty Inlet and north-east to the fjords which we visited, but it does not seem to have any stronger claim than North Galloway, and I have thought it best therefore not to decide on any general name until more is known of the natural divisions of the region.

DISCUSSION

Before the paper the PRESIDENT (Professor HENRY BALFOUR) said: This evening we are to hear an account of last summer's expedition to Baffin Bay and the Canadian Arctic. The expedition, which was led by Mr. Wordie, had various objectives about which you will learn presently. Mr. Wordie is equally at home in the Arctic or in the Antarctic; he has travelled very extensively in both areas and I am sure you are anxious to hear what he has to say with regard to the particular region which was visited under his leadership. I will therefore ask him to give his paper.

Mr. Wordie then read the paper printed above, and a discussion followed.

The PRESIDENT: Mr. Wordie has given us plenty of food for discussion. I should like, first, to ask Mr. Dymond, who was in charge of part of the cosmic ray investigations, to come on to the platform and add something in connection with that part of the work of the expedition.

Mr. E. G. DYMOND: I find it difficult at the moment to talk about the cosmic ray programme of the expedition, for two reasons. First, that it is a very highly technical subject and the details are, I think, not quite suitable except to those interested in the physical side of the expedition. Secondly, I am afraid our observations have not yet been completely worked out. It takes a very long time to get all the information from the data that these balloon flights give.

But I think in general we can say that we were taking, when we started these flights, a great chance in getting any results at all. The weather conditions at sea-level we knew something about from previous experience, but there was practically no information about the winds at very great altitudes, and such information as we had was distinctly pessimistic. If the winds at great altitudes were very high, as we were expecting, the apparatus might be carried great distances and we might not be able to recover it. That is one of the reasons why we had two types of apparatus with us. The situation was saved by the fact that we found light winds at all altitudes and that is the point I particularly want to stress. In addition to the six flights of the big balloons, we had twenty-eight flights of small balloons just to test the wind, spread over a long period. The general conclusion from all these test flights is that remarkably still air was found at all altitudes, and this is a completely different state of affairs from what one finds normally. Our apparatus when it went up never travelled to any great distance. And, as Mr. Wordie has said, on one occasion it ascended to a great height, something like 17 to 18 miles, and came down again within a couple of miles of the starting point. I think from that you will gather we had great luck in getting the information we did.

I cannot say more about the actual information that we have got because it has not all been worked out, but I think it is very hopeful. We have got results we did not expect, and it is always much better to get that than the results you do expect.

I should like to emphasize the suitability of the Arctic for this type of work. A

great deal of physical work has been done on cosmic rays, but previous experiments have practically always been in the laboratory or in comparatively simple conditions. We have shown that, at any rate last summer, Arctic conditions were quite suitable for extended work in this field, and we hope more work can be done in the future. The calm wind conditions make balloon flights very simple, especially when there are extremely clear atmospheric conditions. The atmosphere is, in fact, so clear that it is possible to trace balloons even if they are a long way off.

This technique of balloon-flying is not restricted to the measurement of cosmic rays. There are many physical problems concerned with what is going on in the upper atmosphere. The study of the physics of the upper atmosphere is at present only being initiated. It is a matter of great importance because it is believed that much of our weather is caused by what is going on at high levels; and in particular we want to know its behaviour in the Polar regions.

I would like to add that it is most desirable to continue this type of work in the Arctic, not only for cosmic rays, but for general physical investigations of the upper atmosphere.

There is also the question of temperatures on the surface. Mr. Wordie remarked that gloves were not necessary; I would like to emphasize that he was speaking entirely for himself.

The PRESIDENT: The expedition was not only fortunate in the weather conditions which allowed the experiments to be made, but it was also fortunate in the backing which it received from the Royal Society. That Society made a most generous grant to the expedition and therefore may be regarded as having played a very important part in its success. We are honoured to-night by the presence of Sir William Bragg, President of the Royal Society; can I tempt him to come on to the platform?

Sir WILLIAM BRAGG: As the President has said, the Royal Society very gladly made a grant towards the expenses of the expedition. The Society had many interests in it, one of the chief being that it might be possible by these means to find out something more about these extraordinary cosmic rays which are exciting so much interest; and also as Mr. Dymond has said, to find out something more about the strange things that are happening 20 or 30 miles above the surface of the Earth. I do not know what secret Mr. Dymond has got—I think he has got one—but whatever it may be it is sure to be remarkable, for nothing has been more extraordinary than the discovery that in the upper air there are regions where it is even hotter than on the surface of the Earth.

I think, then, that the Royal Society has been very lucky in the results that have been brought back by the expedition and I would like to congratulate Mr. Wordie and Mr. Dymond on its work. Although we do not know all at present, it has certainly been a success.

The PRESIDENT: Mr. Paterson was a member of the expedition largely concerned, on the one hand, with survey and, on the other, with the archaeology of the Eskimo in the neighbourhood. I will ask him to come forward.

Mr. T. T. PATERSON: I think I will show you some of the string figures which I have learned. I have provided myself with a piece of strong, some 6 feet of window-cord, but it is not quite so good as the sealskin cord which the Eskimo use. I found that the Greenland Eskimo produce the most remarkable string figures in the world, and they are so complicated because they try to express their stories in movement illustrated in these figures.

In this first one which I will demonstrate the triangular object in the projecting point represents a little bird and the mother talking to it says," Little bird, little bird, what is that white flesh you are eating? I want some." The

little bird replies, "No, no," and runs away, at which the figure is completely undone.

The women make most of these string figures. The small boys in some parts of the Arctic are not allowed to play too much because it is thought that when they grow up they will be too apt to become entangled in the heart. In the autumn the women say that it is a pleasant occupation, because playing with these strings entangles the sun's rays, and so delays its setting for the long winter for at least one or two days.

During the winter, when the Eskimo are living in snow houses, string figures form a great part of the family entertainment. As you probably have realized, in the region where we were working the Eskimo have no form of art. They illustrate their stories with these figures, and the result is that they have an extraordinarily large number of them. Part of the education of the boys is given by the older men making string figures showing animals and how to hunt. If they want to tell a story they show it also in a series of string figures. You see here a man stalking a seal. The figure in the middle represents the man as he crawls along the ice. Then, most unfortunately, his dog comes along sniffing on the ice. That of course frightens away the seal, and the man is so disgusted that he stands up and walks away. And that's the end of that figure.

A remarkable string figure the women delight to show each other is known all through the Arctic from Greenland towards Siberia. It is known in Siberia by a similar name—which means hair-pulling. In it you see two Eskimo ladies pulling each other's hair.

The last figure I will show you is the most interesting to me. I got it in West Greenland, where it was known by the name "Kiligfak," which means to the West Greenlanders a monster, and they described this monster as an animal about the size of an umiak (which is the small boat used mostly by the women) and it has six legs. When it dies its flesh does not fall off the bones, and the animal may be born again. I found this figure had no possible resemblance to any animal, except perhaps the legs. In Alaska the same figure appears and refers to the mastodon which they find there buried in the ice.

The PRESIDENT: The subjects which have been talked about could be discussed for a very long time indeed, but, unfortunately, I have to keep an eye on the clock. One would naturally like to hear a great deal more in regard to Eskimo culture which has been discovered in the region. We have learnt something of what one might call the lighter side of ethnography, from those extremely intricate "cat's-cradles" which have been so skilfully exhibited. Although those string figures may seem to be rather trivial, yet from an ethnological point of view they have extreme interest, inasmuch as similar games with string, almost identical in some cases in pattern, have an extraordinarily wide distribution all over the world. You find among the primitive people of New Guinea and elsewhere string figures which are practically identical with those seen in regions very far distant, so that they clearly have an ethnological importance. It is very lucky that one member of the expedition should have been sufficiently skilful and have a sufficiently retentive memory to bring back the patterns used in that particular region. That they are very attractive in themselves as working figures, I gather from your own expression of approval.

There are many other points with regard to Eskimo culture which arise from the excavation work of this important expedition. It is by means of excavation in the old Eskimo sites that we are going to learn in the future something definite about the origin of the Eskimo, their various movements and the inter-relationship of the various sections which are included under the general term "Eskimo," a people extending all the way from Alaska to Angmagssalik.

I fancy, although I have not yet seen the collections which the Cambridge expedition has brought back, that they will have a very considerable bearing upon those rather wide ethnographical problems.

That however was only one of the activities of this versatile expedition. It had other activities than those to which special attention has been drawn. We must not omit reference to the valuable survey which has been conducted and which has caused the map to assume a different configuration for the northern part of Baffin Land from that which existed hitherto. And the discovery of several fjords of very large size is a matter of considerable importance.

I would congratulate the leader of the expedition and his colleagues on having done a very excellent piece of work in several different branches of science. I am sure you will wish to associate yourselves with me in those congratulations.

GEOGRAPHICAL ASPECTS OF THE INDUSTRIAL EVOLUTION OF LONDON TILL 1850

O. H. K. SPATE

THE industrial development of a metropolis is little susceptible of geographical interpretation. In the past, geographers have been much "too prone to ignore the history of industrial development, and the purely economic factors which are involved in the siting of an industry, and have tended to place too much faith in rather lame 'explanations' based entirely on physical circumstances."[1] If this be true in the industrial North of England, where geographical localizing factors were of vital significance, it is difficult to arrive at a just estimate of the industrial rôle of geography in a great urban agglomeration whose primary *raison d'être* was commercial and political. External relations provide the site values, together with the initial impulse to the urban aggregate, and as the economic attraction of a great consuming centre makes itself felt, it in turn brings into existence new groups of industries with their new groups of consumers. Nevertheless, while the outstanding geographical fact is the huge concentration of demand, there are even within the limits of London and its environs some factors of internal geography which are significant for the siting of certain industries, while a sketch of the occupational topography of the city displays also some interesting associations of trades with each other and with particular localities.

The period of the Industrial Revolution was naturally critical for London's place in the economy of the country. After extra-metropolitan competition began in earnest, the time during which London's advantages of marketing were not outweighed either by legal restrictions, such as the Spitalfields Acts, or by Weber's "deglommerative factors," such as high rents, was relatively short. In any case, her capital interests were commercial rather than industrial. Quite apart from the old-established clothing areas in the south of England, which were themselves in decay, the movement away from London (of textiles, for example) was already in evidence before the exploitation of new power resources and the rise of the factory system in the North rendered inevitable the decline of the Spitalfields weavers. Thus after 1730 the framework knitting industry gradually migrated to Nottinghamshire; while in 1833 "there is little cutlery made in London ... it is not unusual for the word 'London' to be stamped on many articles made in Sheffield," as London still retained the prestige of making the very finest wares.[2] But if the North had its industrial, London had its financial revolution, and while its proportion of the country's manufacturing industry declined, it remained the *entrepôt par excellence*, and became the money centre of the world.

To such a centre some industries will of necessity gravitate, and two types of these, the luxury and the engineering trades, deserve special notice.

[1] S. H. Beaver, *Geography*, 20 (1935), p. 191.

[2] W. Felkin, 'History of machine-wrought hosiery' (1867), p. 44; S. C. on manufactures, etc. (P. P. 1833 VI), qq. 2864–8. Quoted below as "1833 VI."

A. F. Weber, while insisting on the decentralizing factors, points out a very important technological feature: "Putting together all the paraphernalia of a great commercial centre, vehicles of all kinds, vaults and safes, railway apparatus, etc., one will see the necessity of the existence in the great city of a large number of mechanical industries. To these must be added the enterprises that cater to the wants of the rich consumers of a commercial city—furniture, table-ware, carriages, etc. Some of these articles might indeed be made outside the city, but there is a considerable advantage in being 'on the ground.'"[1] The net demand was not of course so great at the beginning of last century, but such factors were proportionately stronger owing to the difficulties of transporting heavy goods with only the one recently built canal link (the Grand Junction, 1793–5) between London and the metallurgical centres of the Midlands. For the Birmingham hardware man with a rush order for London it was of no use to apply to the coaches: "the reply always is, You would not like to travel in a coach with 800 or 900 pounds of iron on the top of it, Sir."[2] Again, the wealthier classes were more concentrated around London than they are to-day; and every advertising agent knows how much this factor counts now.

It may be remarked that considerations such as these, as well as the new power developments, are primarily responsible for the new industrialization springing up round London to-day. Dr. D. H. Smith's study 'The industries of Greater London,' although confined to the Middlesex sector, brings out the interesting geographical localization: luxury trades and mobile engineering in the western area (Slough, Perivale, Great West Road: on the roads between Midlands engineering towns and West End consumption), and furniture trades along the gravel shelf overlooking the Lea valley, in continuation of the traditional wood industries of Shoreditch and Bethnal Green.

Besides such technical needs, it must be remembered that London was also the centre of scientific progress. Here the importance of financial and technical connections, abroad as well as at home, cannot be overstressed. There developed an important group of engineers; thirteen were of sufficient substance to give evidence before an inquiry into steamboat boiler explosions so early as 1817. Three of these, including the biggest employer, Maudslay, were from Lambeth; two, entering from the millwright side, from Dartford; the rest lived between the West End and the City, in touch with the professional world on one side and with capital on the other. Alexander Galloway estimated in 1824–5 that there were three or four hundred masters in "various branches of machinery"; but clearly these included many very small men, millwrights and other "mechanists"; altogether there must have been some thousands of engineers. Raw material was largely provided by the abundant scrap-iron of London. In the same way broken bottles made up over half that of the important Southwark glass industry: one firm used about 100 tons of old bottles yearly.

Of the metallurgical works, the most important were Maudslay's and Rennie's, employing in the 1840's about 1000 and 400 men respectively; they had started in 1810 with 150 and 50 employees. Maudslay's exported

[1] A. F. Weber, 'Growth of cities in the 19th century' (1899), p. 207.
[2] N. W. Cundy, 'Inland transit' (1834), p. 98.

half their output, specializing in marine and some railway engineering; Rennie's manufactured minting, dockyard, and dredging machinery, cranes, and mills. Rennie himself was concerned in the Albion Mills at Blackfriars, the first flour-mills to use steam power (1786–91). Despite the small size of the shops it is clear from the inquiries into artisans and machinery of 1824–5 that there was a great deal of machine-work to be done in London. The water companies had long used steam pumping-engines, and they had been introduced into mills and breweries; boilers were needed for sugar and chemical works. Gas works and steamboats added to the demand. Indeed, as early as 1772 we find an indignant complaint against the smoke nuisance in Samual Pegge's preface to a new edition of Evelyn's 'Fumifugium': "But since his time we have a great increase of glass-houses, foundries, and sugar-bakers to add to the black catalogue; at the head of which must be placed the fire-engines of the waterworks which . . . leave the astonished spectator at a loss to determine whether they do not tend to poison and destroy more of the inhabitants by their smoke and stench than they supply with their water." [1]

One point of importance is that the London workman in these trades was much more versatile than his counterpart in the industrial areas. There a more highly specialized craftsmanship had set in; the demand called already for something like mass-production of standard parts or at least types, in contrast to the more varied requirements of the metropolis. "That division of labour is of great advantage in articles of great consumption; but while it makes cheap goods, it does not make general workmen; a too great division of labour circumscribes the power and intelligence of the workman, which is the great mischief of abstract employments; it makes men mere machines" —it might be a modern sociologist speaking instead of one of the largest employers of 1825—"and we find that the Manchester and other country workmen . . . are very inferior"; quicker but less accurate even in their own lines. Not only was there a wider choice of the best men, attracted to London by the number of masters and the high pay, but new tools and new capital were on the whole more easy of access. This factor of versatility in the new industrial development round London has been recently re-emphasized.[2]

As regards the luxury trades, the smaller branches were often located on the margin of the West End; one may perhaps compare the Berwick Street outlier of the clothing trades to-day. Chelsea at various times harboured a silk factory, the famous china works, bakeries for "bunns," a firm producing artificial stone ornaments and casseroles, a filter-making works, and a firm producing elaborate papers for interior decoration (a trade also carried on at Kensington), while Fulham had carpet and tapestry works. Such decorative arts were fashionable and therefore ephemeral, but their location in relation to the West End market is perhaps significant. Among these may also be

[1] S. C. on steamboats on the Thames (1817 XIII); on artisans and machinery (1824) V), p. 19; on export of tools and machinery (1825 V), pp. 155–6. Also, E. W. Brayley,' Topographical history of Surrey' (1841–8), V App. I, pp. 6–7, 34–7, 44. All references are to this appendix.

[2] 1825 V, *loc. cit.*; *Geogr. J.* 92 (1938) 36–7.

grouped the china works at Bow, the enamels of Battersea, and the lace made at Kensington in the 1820's. Important also, and significantly placed, were the coachmakers of Long Acre.[1]

The influence of fashion is strong also in the scattered fine clothing trades. There is no intrinsic geographical interest in the East London textile trades, but it may be noted that in 1851 there were still some 5500 silk weavers in Bethnal Green and Whitechapel and, as might be expected, Spitalfields led Lancashire and Cheshire longer in the manufacture of fine silks than in cheaper lines. In the eighteenth century, and at least as late as Jane Austen's time, the pre-eminence of London as a shopping centre was vastly greater than it is to-day; only in a few provincial towns, Bath, York, perhaps (remembering Defoe and Cleone Knox) Derby, would there be an attractive choice for the Squire's lady. Those who ministered to her, as well as the superior hatters and shoemakers, were well scattered in the West End and the best streets of the City. By 1833 the practice of ticketing the prices of goods was spreading, more rapidly in the East End and in middle-class shopping areas. The tendency for the better shops to move west was now strong, but it had already been noted as far back as 1662 by Graunt in 'Observations on the bills of mortality,' and it is confirmed by seventeenth-century lists of goldsmiths. Nevertheless Fleet Street, for instance, was still a great shopping centre, suffering from the "very great concourse of carriages, which are held to be an objection rather than an advantage to trade." [2]

The metropolitan food industries, dispersed in small units, formed no inconsiderable aggregate. Corn-mills generally clung to Thames or Lea, for convenience of supply after the need for water-power had vanished; they were most numerous in Bermondsey (by the middle of the century Shad Thames was almost entirely devoted to them) and the mediaeval milling centre at Stratford was still important. After the burning of the Albion Mills in 1791 those at Wandsworth were the largest, producing 60,000 sacks a year "partly by steam and partly by water-power . . . not fifty men are required to prepare and distribute flour for 50,000 persons." The King's Mills at Rotherhithe, originally used for Navy biscuits, employed twelve or fifteen men, and this was probably the more usual size of the unit. Breweries and distilleries were more widely spread, though still not far from the waterside as a rule. Apart from these the most considerable, and the most concentrated, of the alimentary industries was sugar-refining. It was found in the City parishes next the river, and above all in the waterside districts of East London, adjoining the Sufferance Wharves where alone customs regulations permitted the landing of sugar until the West India Docks obtained the monopoly in 1802. According to the 1851 Census 1037 of those engaged in sugar-refining were in Whitechapel, St. George's-in-the East, and Stepney, and only 105 in all other districts.[3]

[1] All these from D. Lysons' 'Environs of London' II (1795), pp. 148–9, 379–80, 113–4; V. C. H. Essex II (1904), pp. 415–7; V. C. H. Surrey II (1902), pp. 305–6; *Annual Register* (1822), p. 91 of Chronicle.

[2] 1833 V, qq. 1406–7, 1439–44, 1766–70.

[3] J. P. Malcolm, 'Londinium Redivivum' IV (1807). All references to the 1851 Census are to vol. II of Population Tables (1854 LXXXVIII Pt. 1), pp. 16–27.

Scattered through the East End and more especially in the poorer suburbs on the Surrey Side were the offensive trades such as bone-boilers, floor-cloth factories (there was also an important group of these in Islington), and the Prussian blue works of Southwark, "an odious stinking business." In 1857 "in the mile length of Rotherhithe Street there are no less than nine factories for the fabrication of patent manure; that is, nine sources of foetid gasses," and a whole group of trades consumed the offal and poisoned the atmosphere of Smithfield.[1]

In the eighteenth century there had been three or four strongly marked industrial areas around the City: the light metal trades, engravers, printers, and so on, of Clerkenwell and Bishopsgate; eastwards the monotonous Spitalfields streets of weavers' houses with their long upper galleries for the looms; south and east the waterside trades, ropewalks, coopers' and boat-builders' yards, oil, colour, and soap works. Across the river there was a similar confusion of waterside trades where Rotherhithe and Deptford reached out to each other along the river-wall, as well as the very important concentration of tanners in Bermondsey.[2] These areas still preserved their characteristics in the nineteenth century, and indeed do so even now in large measure: it is sufficient to mention Clerkenwell printing and metalworking and Bermondsey's leather; but the clothing trades of modern Whitechapel are largely a new development, influenced by the late nineteenth-century influx of Jews from Eastern Europe. It would be tempting to linger over the relations of the East End with religious emigration and the textile trades, from Strype's uncle, a refugee from the Low Countries who introduced silk-weaving to Petticoat Lane, down to the costumiers and furriers who line Commercial Street and Road to-day.

Clerkenwell jewellery and watch-making are still entrenched and reinforced by such new products as electrical and wireless apparatus and motor accessories; nevertheless in the seventeenth century there was already the tendency noted above for retail goldsmiths' shops to migrate to the West End. Thanks to the big market the slightly heavier battery trades (*i.e.* brass and copper cooking utensils, tubes, wire, etc.) still existed in places near London with good water-power, *e.g.* Prince Rupert's Temple Mills at Hackney, mills at Isleworth and Rotherhithe (Jacob's Island was rolling lead as late as 1850), the Tower Mills at Mitcham and other Wandle firms, and the copper-rolling mills at Walthamstow (1807–45). But after 1750 the competition of the Midlands, especially Birmingham brass and copper ware and Derbyshire lead, became increasingly keen as provincial manufacturers opened their own agencies and show-rooms in London. In 1799 London factories were estimated to consume 1000 tons of pure copper per annum, exclusive of sheathing for ships. In 1833 the aggregate of the brass-founding carried on in London was practically equivalent to consumption, and small manufacturers were still setting up; nevertheless a large supply of brass fittings, etc., came to

[1] R. Campbell, 'The London tradesman' (1747), p. 106; H. Jephson, 'The sanitary evolution of London' (1907), pp. 114, 117–8; F. Byng, 'Smithfield and Newgate Markets' (1851), pp. 17–8.

[2] H. C. Darby (ed.), 'Historical geography of England and Wales before 1800' (1936), p. 534 and Fig. 86.

London, to some extent for re-export. Cheaper labour was an important factor favouring Midland competition.[1]

More important than these were the specifically waterside industries of south and east London. Shipbuilding had long been the keynote of Deptford and Poplar, gathering round itself a host of associated trades, boat-building slips, coopers' yards, ropewalks, sail and block factories, and various foundries. At these places there were holes of deep water on the outside of the meanders, which also led to the great prosperity of Blackwall as the terminal for East Indiamen and, on a smaller scale, of Deptford for West Indies ships. The units were small, but later London played a leading part in the change-over from wood to iron: the *Aaron Manby*, the first iron steamboat, was assembled at Rotherhithe for her crossing to the Seine in 1822. Fairbairn opened his yards at Millwall in 1833, and from the 1840's iron shipbuilding at Millwall and Blackwall increased yearly. "In 1845 the land on the Essex side of Bow Creek was practically all rough pasture and marsh, much of it submerged at high water. By 1854 this waste land . . . had become one of the greatest shipbuilding centres of the world." [2] The *Great Eastern* was launched from Millwall in 1858, and a little later came the great days of the "Blackwall frigates." The fact that almost the only natural advantage for the industry was the river itself is an impressive tribute to the attractive power of Thames commerce, itself so deeply rooted in geographical conditions.

The allied foundry trades were and are of great importance. It is hardly necessary to mention the early naval and armament activities at Deptford and Woolwich, although their sites are of course mainly conditioned by the deep-water convexities of their respective reaches, but the development of Thames-side iron-founding deserves more attention. The most important early name is that of Ambrose Crowley, ironmonger and alderman in 1711; although he shifted his main works to Winlaton, near Newcastle-on-Tyne, he retained his connection with Greenwich, where he had a branch for urgent orders and repairs which still existed in 1796, as well as a selling agency in Thames Street.

After 1750 London developed as an iron *entrepôt:* owing to the difficulties of overland transport London founders depended largely on Swedish and Russian ores, and in that year colonial pig and bar iron were exempted from duty in order to compete with the Baltic imports. The *entrepôt* nature of the trade is well shown by a pamphlet of the 1780's ('Iron trade: England and Ireland'): "Most of the Iron slit into Rods used in Ireland has been imported from London, where it is brought from Russia, much cheaper than it can be carried to Dublin. It is frequently imported to London as Ballast (with Hemp in general)" at about a third of the usual freights. Eden's commercial treaty with France produced fierce debate in the industry between protectionist iron-workers and the free-trade producers of pig iron by the newer methods. It revealed

[1] W. Jacob, 'Inquiry into the use of precious metals' (1823), II, pp. 291, 413; S. C. on watchmakers' petitions (1817 VI), pp. 5–7, 15–7. For battery trades, H. Hamilton, 'The English brass and copper industries to 1800' (1926), pp. 48–9; S. C. on copper mines and trade 1799 (P. P. 1715–1802 X, pp. 665, 670); 1833 VI qq. 4450–3.

[2] *P. L. A. Monthly* (January 1928), p. 79. By 1862 more iron than wooden ships were being built.

the isolation and the relative weakness of the London industry in face of the rising new interests in the North. "The capitalists in the older industries, and those of London in particular, were bitterly hostile," while the majority of the recently formed General Chamber of Manufacturers supported a resolution in favour of the treaty; but in February 1787 at a special meeting in London the older interests were able to outvote the newer producers of the coalfields. "From the fears expressed lest the trade in anchors to Portugal should be lost to England, it appears that the anchorsmiths of the Thames estuary—always a body standing aloof from the other iron industrialists—were among the opponents of freer commercial intercourse. . . . On July 25, in a letter which indicates clearly the cleavage between the older centres and the new industrial regions, Watt informed Wedgwood of his project '. . . to have nothing to do with Londoners except on particular occasions.' " Finally "the Government was able to complete the agreement with France, undeterred by the resistance of the protectionist Londoners."[1]

Nevertheless firms like Folliot Scott's of Rotherhithe played an important part in the general advance of the metallurgical industries; this firm had early relations with Boulton and Watt, helped Cort with his puddling and rolling experiments, and provided a link between the small-scale eighteenth-century founding and the flourishing mechanical engineering of Bramah, Galloway, Maudslay, and the Rennies. The importance of site-factors and the nature of the largely nautical demand can be seen from an account in Lysons' 1811 supplement to the 'Environs of London': "Some very extensive iron-works have been lately established at Mill-Wall, near the canal and West India Docks, by Jukes Coulson and Co. In their forge and rolling-mills, which are worked by two powerful steam-engines, one of 60, the other of 20 horse-power, are manufactured from scrap-iron, bar and bolt iron for the use of ship-builders and coach-makers, and iron-hoops, sheet and rod-iron for home consumption and exportation . . . anchors and mooring-chains of any size, and all kinds of heavy forged iron-work for the navy and land-service . . . adjoining these works is a very extensive ropewalk" as well as various oil and turpentine distilleries. There was thus no lack of tradition, either on the metallurgical or on the marine engineering side, to encourage Fairbairn's venture. About 1850 these conditions gave rise to a new and kindred industry, still very important on the Thames: the manufacture of electric cables.

Before leaving the heavy industries a word should be said about the very rapid expansion of gas production. In 1814 there was only one gasometer, with a capacity of 14,000 cubic feet; figures for succeeding years are: 1823, 47 gasometers, 900,000 cubic feet, 61,203 private and 7268 street lamps; 1846, 176 holders, 5,500,000 cubic feet, 134,300 and 30,400 private and public lights respectively. By this time coal consumption was about 180,000 tons per annum, and the eighteen works were mainly on the river or the Regent's or Grand Surrey Canals, for cheapness of coal supply from the colliers in the Pool. Horseferry Road and Nine Elms were already in existence, but it was only in the early 'fifties that the Newcastle coal monopoly was broken down by the Great Northern; the other railways took Tyne coal outwards. Big works were then built near northern goods sidings (*e.g.* between King's Cross

[1] T. S. Ashton, 'Iron and steel in the Industrial Revolution' (1924), *passim.*

and St. Pancras stations), but waterborne coal is still predominant for gas and electricity production.[1]

Builders of course were found all over London, particularly in the rapidly expanding peripheral districts. But many of the timber merchants still clung to the Thames, particularly in the great yards on the central bend of the river at Lambeth, so famous in Pennant's day. The brickmakers naturally congregated wherever the brickearth had not yet been replaced by bricks and mortar; some bricks came in by river and canal, but the great Peterborough fields had not yet been developed. Unworked areas however were not numerous, although much of the eighteenth-century expansion on the Taplow Terrace, both east and west, had used bricks made on the spot. At the beginning of last century the leading district was Hackney; Middleton remarked ('Agriculture of Middlesex,' 1807) that around Kingsland Road the surface had been lowered about 5 feet over an area of 1000 acres. In 1851 the only districts with more than a hundred brickies were Islington (232), Kensington (188), and Hackney (177); over a third of those south of the Thames were in Camberwell. Nevertheless brickmaking was not insignificant among the market gardening, dairying, and other "open developments" of the urban fringe.

Prominent on the Surrey Side were the tanners, a very numerous compact group in Southwark and Bermondsey, by far the biggest leather centre in the kingdom in the early part of the century. The disposition already noted "to make of Southwark a convenience for more disagreeable occupations which were essential to the life of the city was little doubt a main factor in the settlement of the leather industry on the Surrey side," but this was only one of a whole group of offensive trades relegated to such a position, including in early times most of those using large quantities of coal.[2] The plentiful river-borne fuel supply assured by the great domestic demand of London was a major element in the industrial life of north Surrey; another was lack of space on the City side for expanding firms. But it seems very probable that other geographical factors were involved. The oak-woods of Bermondsey, for which there is some evidence, no doubt supplied tannin bark in early days, while the clustering of industries around the Neckinger stream-complex suggests that tidal-power and a plentiful and easily controlled supply of water for steeping the hides were also of some importance.

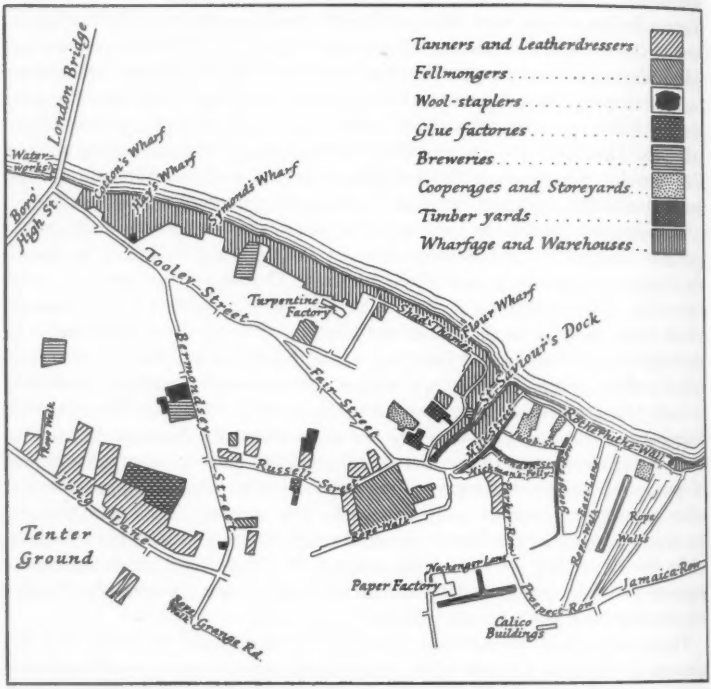
There were close connections between the Smithfield butchers and the tanners; in 1832, as a result of the City Corporation's unfavourable attitude to representations as to the inadequacy of the Leadenhall hide market, a Leather Exchange was set up in Bermondsey itself. The industry in 1812 was still perhaps one of the three or four most valuable in the whole country, and in that year the London district, essentially Bermondsey, paid one-eighth of the total duties on leather. But the size of the units seems to have been small compared with those of the new firms in Northampton and Stafford. Thus in the late 'forties Hepburn's of Long Lane, the biggest establishment in Bermondsey, taking a quarter of the calf-skins consumed in London, employed only 250 men, while the famous firm of Bevington's at the Neckinger Mills,

[1] J. Fletcher, *Journal of Statistical Society*, 9 (1846), pp. 211–2; *Annual Register* (1823), p. 242; Brayley, *op. cit.*, p. 42.

[2] V. C. H. Surrey II, pp. 247–9; Brayley, *op. cit.*, pp. 4–5.

specializing in rather finer goods, had 85 hands. Its power was provided by a 6-h.p. engine, an apt reminder that in the older trades the scale on which steam was applied was still small, even though as long ago as 1699 Savory had tried to apply his engine to industrial purposes at a Lambeth pottery.[1]

Associated with tanning were numerous subsidiary trades such as fellmongering, glue-making, wool-stapling, parchment-making, and chemical trades. Horwood's map of the area in 1799 illustrates the division between the riverside trades such as boat-building, cooperage, and warehousing, and the leather trades centring upon Long Lane and reaching out to the old tidal



Bermondsey trades in 1799. From R. Horwood's Map of London

ditches around St. Saviour's Dock. Finally, the river also assured easy transport for such heavy raw materials as the clay for the potteries which were largely concentrated at Lambeth, where there was a long-established group of small firms. The giant amongst them was already Doulton's, employing however only 100 men in 1846.[2]

Surrey again had the most interesting of the metropolitan textile trades.

[1] V. G. H. Surrey, *loc. cit.*, and pp. 285, 329–41; Brayley, *op. cit.*, pp. 30–1; S. C. on duties on leather (1812–3 IV), pp. 5, 44, 58 *sqq.*; on the apprenticeship laws (1812–3 IV), pp. 55–6; G. W. Phillips, 'History of Bermondsey' (1841), pp. 102–8.

[2] V. C. H. Surrey II, pp. 281–95; Brayley, *op. cit.*, pp. 37–8.

Although the silk-weaving of Spitalfields was numerically greater, its interest is far more sociological then geographical. The calico-printing industry however made definite topographical demands: "a Situation plentifully supplied with good Water, and Grounds for bleaching and drying the Cloths."[1] These conditions were best obtained on the Wandle (and to a less extent on the Darent and the Lea), where there was also easy access to the very important fullers' earth of the Lower Greensand between Reigate and Godstone. To provide an outlet for its products the Surrey Iron Railway was built in 1801–3 and the Croydon Canal in 1809. The Surrey Iron is well known as the first public railway; its continuation, projected to the fullers' earth quarries at Godstone, never reached farther than Merstham, but there was a fair traffic in chalk, lime, coal, and other bulky materials. Technical improvements in the calico trade led to a reduction of labour easier to make in the less regulated provinces, and by 1851 there were only 473 calico-printers left in the Home Counties, most of them in Croydon and Dartford.

Finally, something may be said about the occupational topography of London as shown by the 1851 Census. The classification used is extremely defective from a geographical point of view, at least when studying a metropolitan economy with its big element of small tradesmen and artisans. Thus innkeepers and domestic servants are grouped with tailors, hatters, and shoemakers, while watchmakers, engineers, and shipwrights all come under the general heading of "artisans" (along with publishers and musicians, but excluding painters and architects), and boilermakers are in the same class as iron-miners, far away from the engineers.

Although a general view is therefore rather disappointing, even the negative features bring out some of the essential aspects of London life: for instance, the very large number of small artisans and retailers, spread out in even proportions in every district. Facilities for credit, ease of access to those engaged in allied processes or to wholesalers and warehousemen (with the corollary of carrying small stocks, an important point for those with little capital), the huge market with distribution ready to hand: all these made London the paradise of the small man. The small size of London firms is still noteworthy. Yet even so it is surprising to find that only seven firms returned themselves in 1851 as employing over 350 men: three builders, and one each of silk-manufacturers, stationers, cabinet-makers, and engineers. Two of the five firms in the 300–350 class were also engine-makers. (These figures throughout are only for males over twenty years of age.) Out of 24,323 "employers," 10,694 made no return or employed no men; of the rest, only eighty employed over 100 men. Building was the only trade in this class to reach double figures (22 firms); then came six firms of engineers and five firms each of shoemakers and printers. 3182 masters employed one man, 3092 two men each.

Professional men, domestics, and those engaged in personal service show a fairly well-marked decline from west to east, as might be expected; Marylebone has the absolute (14,085) and St. George's Hanover Square the relative

[1] R. Campbell, *op. cit.*, p. 116. The best treatment of the Wandle is by F. Braithwaite in *Proceedings of the Institute of Civil Engineers*, 20 (1860–1), p. 191; of the Surrey Iron Railway, F. G. Bing's eponymous pamphlet published by the Croydon Public Library, with map, plates, and bibliography.

(9324 out of a total adult male population of 20,602) maximum. The small numbers of merchants, bankers, and other commercial men returned in London City (only 1463 out of 16,268) together with the wide dispersion of this class in the better-known suburbs, shows how far the outward movement, already notable in the 'thirties, had gone, at least as concerns principals. Shopmen, warehousemen, and clerks might still live on the premises (though not to the same extent as two or three decades earlier), but their masters had gone west, north, or south, a movement whose implications are described in Norton's 'Commentaries' (1829) and in Fletcher's splendid articles in the *Journal of the Statistical Society* for 1844–7. The large proportion engaged in transport in Marylebone, St. Pancras (still very high), London City and the waterside districts north of the Thames is also noteworthy. But the total numbers engaged in transport were only about 3·5 per cent.; most people, and especially the poor, lived within walking distance of their work.

Turning to some specific points, the persistence of watchmakers, tanners, and sugar-refiners in their old haunts is very marked: watchmakers indeed are naturally more widely spread than the others, but even so a big concentration in Clerkenwell, St. Luke's, and Shoreditch is evident.

The distribution of heavy industry shows clearly the interdependence of transport, shipbuilding, and engineering. The railwaymen are mostly massed in St. Pancras (921 out of a total of 3542). There was no station of that name as yet, and the Great Northern had only just come to King's Cross, but Euston had been in existence for nearly fifteen years. In Surrey a third of railmen were in Lambeth (306, at Nine Elms, the old, and Waterloo, the new, terminus of the South Western). Most of those in Kent were in Greenwich, the outer terminus of London's first passenger line. Bermondsey, with Bricklayers' Arms within it and London Bridge just outside, also ranks high. The relatively large figure of 241 for non-industrial Kensington is of course accounted for by Paddington.

St. Pancras has also the biggest engineering group of any of the west and north-west districts. Westminster and St. George's, with surprising numbers of engineers, owed their eminence to Bramah's at Pimlico, as did Lambeth to Maudslay's, though there were many other important metallurgical shops in the district. Those shown as "engine, tool, and machine makers" in Clerkenwell, St. Luke's, and Shoreditch, probably provided the delicate tools for the watch and scientific instrument makers of these localities. The close connection of ship-builders and boilermakers is obvious; of the twenty-nine anchor-makers, eleven were in Poplar and nine in Stepney.

Of the variety of London's industries there is no end, nor was there in 1851. There was even a sprinkling of thirty coal-miners, in what sense it is difficult to determine. The aggregate, if made up of small units, was yet enormous; and if this century has seen a great extension of heavy trades down river and the new developments along the great roads, yet the industrial pattern of inner London was already blocked out a hundred years ago. Galloway's praise of the versatile skill of the London workman may be applied to London herself. Without the traditional self-consciousness of the North's specialized industrial towns, every industry was represented within her borders; and in many she was great.

INTERNATIONAL GEOGRAPHICAL CONGRESS, AMSTERDAM, 1938

Continued from the October Journal

THE president of *Section I, Cartography*, was Professor Baeschlin, of the University of Zürich. The principal subjects discussed at the meeting were air photographic surveying, the representation of relief, map projections, and the International 1/M Map. The most important contribution on the first subject was Professor Schermerhorn's paper on photogrammetric instruments, embodying the results of his experience in Holland and the Dutch colonies, which led to a long and valuable discussion. Mr. O. M. Miller, of the American Geographical Society, also contributed a valuable and very interesting paper on the mapping of northern Labrador from oblique air photographs. The question of how to show relief on maps was chiefly discussed in connection with the presentation of the new Swiss 1:50,000 map and the method of representing the high Alps thereon. On the subject of map projections Brigadier MacLeod read a paper on projections for the topographical maps of Africa. The proposals in the paper were originally put forward at the last Empire Conference of Survey Officers, where they provoked considerable controversy. In the discussion which followed the paper the proposals were generally supported, especially by Commandant Tardi, of the Service Géographique de l'Armée. Eventually a resolution was passed requesting the Union to bring them to the notice of the governments concerned.

An account of the present position of the International 1/M Map was presented by Major Sanceau, the Secretary of the Bureau Central, who referred to the need for another meeting of representatives of the adhering countries. He asked for the co-operation of the International Geographical Union in holding this meeting on the occasion of the next General Assembly, and a resolution to this effect was submitted to the Executive Committee.

In discussing the future work of the section, it was agreed that the section should not concern itself with cartographical technique, but with the results alone. Problems of technique should be left to the International Union of Photogrammetry, or to the International Congress of Surveyors. The exhibition of maps, open throughout the Congress, included a number of interesting new publications, among them a new sheet of the 'Tabula Imperii Romani' (Lugdunum), some new sheets of the International aeronautical map (1/M), and the first sheet of a new 1/M oceanographic series (South Sandwich Islands).

M. N. M.

Those interested in air and terrestrial photogrammetry had the opportunity of inspecting some of the latest instruments at an exhibition by the firm of Zeiss, which was on view in one of the rooms of the Colonial Institute. Two new wide-angle aerial survey cameras, the RMK P10 and the RMK 20/3030, both fitted with the new Zeiss Topogon wide-angle objectives, were shown. The firm claims very reasonably that the P10, with its high light transmission, practical freedom from distortion, and wide angle of view (95 degrees), is more economical in use and more accurate in operation than

the various multiple-lens cameras now on the market. A great advantage of the large angle of view is the increased air-base obtainable, so that when pairs are viewed stereoscopically the relief model appears in exaggerated relief, and higher precision of plotting is obtainable. A feature of the new P10 is its mounting, which enables it to be rocked to take obliques on alternate sides of the vertical plane through the line of flight. It is the wide-angle objective that makes this possible by increasing the overlap of alternate "verticals." The result is a widening of each strip, and a saving of flying hours. The P10 should be of particular use for large-area small-scale surveys of little-known country lacking in control points. The focal length of the objective is about 4 inches, and the camera is fitted for hand, electric, or air-screw drive. The RMK 20/3030 wide-angle aerial camera has a Topogon objective with the same angular capacity as that of the P10, but the focal length is about 8 inches.

In this exhibition there were also shown a Multiplex aero-projector, a stereo-cartograph for plotting terrestrial pairs of photographs, a radial triangulator, folding stereoscopes with tracing stereometers, besides a number of ordinary theodolites and other instruments, many of them embodying features of new design. Of particular interest was a tiny photo-theodolite designed especially to meet the needs of mountaineers. It is the first to be constructed, and was only completed a week before the Congress met. The idea has evidently been borrowed from the experimental Watts-Leica combination at the Royal Geographical Society which has been found so useful for high-altitude work in the Himalaya.

This exhibition was of great practical use as a preliminary to the visits to the Hague and to Delft. I am particularly indebted to Herr Hess and Dr. von Grüber, of Jena, who took much trouble to explain the instruments.

The section visited the Topographical Service at the Hague and the Geodetic Institute at Delft. A very interesting afternoon was spent at Delft, where under the direction of Professor W. Schermerhorn a full programme of aerial mapping is in progress. The visit was too short to get more than a very superficial idea of what was being done. The Institute appears not only to be attached to the Technical University at Delft for instructional purposes but also to act as the official Photogrammetric Service of the Ministry of Public Works.

There are at this Institute no less than three high-precision stereo-plotting machines: two Zeiss stereo-planigraphs and one of the recently designed Wild machines. This is a contrast to the position in England, where no precise instrument as yet exists. It is understood that there are now more than one hundred Zeiss planigraphs in use throughout the world, not to mention precise instruments of other patterns; England must be the last of European countries to be without at least one.

The first Zeiss stereo-planigraph (No. 37137) reached Delft in July 1932, and in the years that have followed it has been used for large-scale plans, surveys for engineering, road construction and hydrographic projects, cadastral work, the accurate contouring (1 and 2-m. intervals) of the dune country, and similar work on large scales from 1 : 1000 to 1 : 8000. More recently it has been used for aero-triangulation on scales of about 1 : 40,000,

for air-photographic surveys on scales down to 1 : 100,000. Between 1932 and 1936 this instrument was in use for an average daily period of eighteen hours, while during the last two years the machine has been fully employed throughout the twenty-four hours for six days in the week. Shifts are of eight hours with twenty-four hours' rest for the operators between shifts, and each operator works for seven hours of his shift with a one-hour break. The shift-time of each operator is therefore forty hours a week, and his actual working time about thirty-five hours. This machine has been operated altogether for over thirty thousand hours, and except that two screw spindles have recently been replaced and the automatic pencil may have to be changed shortly, the machine is in the same condition as it was when bought over six years ago.

In spite of treble shifts on this machine, it was found impossible to compete with the work of a large contract for aero-triangulation in New Guinea, and in 1937 a second Zeiss stereo-planigraph (No. 55265) was purchased. This also is in full operation on treble shifts, mainly on air-strip triangulation, while a few weeks ago one of the new Wild machines had been purchased. Meanwhile the old Zeiss machine was recently tested against the new one, both triangulating the same strip of country independently. The results given by the two machines were identical. It remains to be seen whether the new Wild, which is beautifully designed and constructed on the old direct principle of Pulfrich, will also give identical results, and whether it is as simple and as quick to operate; as a first model of a completely new design it may require slight modification as the result of extended experience.

The cost of the Zeiss planigraph delivered in Holland is about £7500: the first one was purchased by the State, while the price of the second was included in the contract for a large area of survey abroad. It has already more than paid for itself. The Wild machine, which costs somewhat less, was bought out of profits, as will be a fourth machine which Professor Schermerhorn contemplates purchasing either at the end of this year or the beginning of next.

The Institute has three Multiplex aero-projector sets for less precise aerial surveying. This invention of the Zeiss firm has now been in use for about three years. The machine was primarily designed for the drawing of maps on small scales, 1 : 40,000 to 1 : 100,000, and has a number of individual projectors which can be made to represent the aerial camera in successive positions of exposure. One of the machines in use at Delft is fitted with no less than eighteen projectors, and is so arranged that operators can work at opposite sides of the table alternately. The principle of anaglyphic stereoscopy being employed makes this alternate arrangement very convenient. Plotting is done by hand and not automatically as with the precise machines. The Multiplex is also used for strip triangulation, but there is much more scope for personal errors than with the planigraph.

Professor Schermerhorn finds the Multiplex of considerable use for training operators in the theory and practice of stereoscopy; not until they are proficient in the use of the Multiplex are they allowed to operate the planigraph. Anaglyphic stereoscopy appears to be a greater strain on the eyes than direct stereoscopy; not only are shorter shifts and shorter hours per week desirable, but accuracy tends to be lost at the end of a shift. This sometimes entails

the new shift working back over the ground already plotted, and consequent loss of time. Professor Schermerhorn informed me that in spite of the considerably higher cost of the planigraph he is convinced that it is actually more economical to operate for triangulation than the Multiplex, while it is far more accurate.

There were two different types of radial triangulator, besides a number of simpler stereoscopes being used for various purposes. The whole process of aerial triangulation was demonstrated: the lay-out of the network, the selection and marking of the points on the photographs in simple mirror micro-stereoscopes; the execution of the triangulation in the various machines, planigraph, radial triangulator, and Multiplex; and the adjustment of the results.

The visit was far too short for a detailed study of the work, but the scientific thoroughness, the efficiency and the organization of the whole undertaking were most impressive. It was also of particular interest in view of some of the criticisms that have been levelled at precise plotting machines by professional surveyors in this country, *e.g.* that the various continental manufacturers claim for their instruments functions that they cannot perform, that these instruments are uneconomic, that they require expensively trained and highly educated experts to operate, and, paradoxically, that even if they can do what is claimed for them, there is no work for them here, or maps of such accuracy as they produce are not required. Professor Schermerhorn organizes and runs his concern on lines that will pay. He buys those instruments that are of use to him, and is not bound to buy from any one firm or from any one country; he develops the uses to which his instruments can be put both to the advantage of his clients and to himself. K. M.

Five outstanding subjects were dealt with by *Section IIa, Physical geography*: glacial erosion, especially in relation to the formation of the stepped longitudinal profiles exhibited by glaciated valleys; terminal moraines; Piedmont steps (the *Piedmonttreppen* of the German geographers); Pliocene and Pleistocene terraces; and Tertiary erosion surfaces. In a brief note attention must be directed to those fundamental questions in each field that produced most discussion, so that of necessity a great many interesting papers, which owing to the restricted nature of both their subject-matter and area investigated called forth little comment, must be neglected.

Probably the most important paper on glaciology was the as yet unpublished analysis of ice-erosion, along simple mathematical lines, in relation to the stepped longitudinal profiles of glaciated valleys and in particular to "over-deepening" (*surcreusement*), by Professor Dr. H. Louis. This was in direct support of the well-known theories of Professor de Martonne published during the first decade of this century. Dr. Baulig, of Strasbourg, expanded Louis's thesis, drawing particular attention to the fact that when discussing ice-flow in contradistinction to water-flow there is "no accumulation of energy downstream." It must have been pleasant for Professor de Martonne, who commented upon the paper, to hear his own views independently vindicated by a geographer from Germany, where the views of the elder Penck and others have been unchallenged for years. Professor C. Sittig, of Thann,

gave an elegant demonstration, wholly convincing, of glacial excavation in the Vosges. By utilizing both longitudinal and transverse valley profiles it was possible to determine, with remarkable accuracy, the actual depth eroded.

With regard to morainic studies, the question examined was: "Are those hills found in the northern plains of Europe and America, known as terminal moraines, due to accumulation or to thrust?" This problem drew relatively little response, probably, as Professor Lencewicz suggested, because the question was to be examined from a geological viewpoint, whereas the Congress was a geographical one. No real solution was reached, but the papers certainly brought out the complexity of the problem owing mainly to the number and diversity of factors involved. On the question of *Piedmonttreppen*, the German geographers brought much material on this favourite subject of theirs, but their theorizing was based on premises so patently false that little discussion was possible. It is strange that W. M. Davis's trenchant exposure of the fallacies underlying Walther Penck's 'Die morphologische Analyse' should be ignored by them. However the occasion is memorable for what was probably the most brilliant address heard at the Congress by this section. Professor Baulig, of Strasbourg, with ruthless logic and the utmost clarity of expression, illuminated the whole sequence of misconceptions upon which the *Piedmonttreppen* theory rests, including the extraordinary belief that valley walls formed by the downcutting of a stream retreat, once formed, parallel to their initial positions. This address was warmly received, and not a single challenge was offered to him. Professor de Martonne suggested that in future it would be an excellent thing if those defending *Piedmonttreppen* would produce maps showing where they exist in the field.

In the fourth subdivision, that of Pliocene and Pleistocene terraces, special mention must be made of the excellent work being done in Romania, which was further reported on at the Congress by Romanian geomorphologists. This work has been carried out with extreme care, particularly with regard to levelling, and by investigators who are very much alive to the difficulties inherent in this important line of research. Very noteworthy are the results obtained from the rivers of the eastern border of the Pannonic basin: the numerous terraces, very well preserved, are due not to rejuvenation consequent upon tectonic disturbance but to changes in local base-level, that of the retreating Pannonic Sea.

Italian geographers presented members of the Congress with a handsome volume of studies on fluvial terraces and marine benches in northern and central Italy ('Ricerche sui terrazzi fluviali e marini d'Italia'), thereby further indicating the great interest taken in this subject, an interest now international.

Before passing to the final section, mention should be made of the very interesting contoured map presented by Professor Dubois, of Strasbourg, showing the topography of the basement on which the Quaternary formations of maritime Flanders repose. This surface is a vast plain, gently inclined seawards (10 metres in 2–5 km.). It would appear that the Aa and its tributaries flowed, in the pre-Flandrian, across this surface to a very depressed, but very distant, sea-level at about −100 metres. This level is

that which the sea-level reached during the glacial maxima, particularly during the Würmian, the best known phase.

The last subdivision, that of Tertiary erosion surfaces, aroused quite as much interest as the terrace question. Mlle. Lefèvre, of Louvain, presented a most interesting paper and map of the bevelled surfaces of the Belgian Ardennes and their foreland. The method utilized in their determination, apart, of course, from field-work, was that of projected profiles, so much used by geomorphologists in the United States. In this way Mlle. Lefèvre was enabled to demonstrate the presence of an infra-cretaceous peneplain, both deformed and exhumed, and also cyclic erosion surfaces and *replats*, at heights of some 500, 400, 300, and 200 metres above present sea-level. An excellent paper on quaternary surfaces in Louisiana, by Professor Russell, of Baton Rouge, was outstanding. In the light of his investigations the comparatively flat surfaces separated by escarpments rising back from the northern shore of the Mexican Gulf are not marine terraces—the view most widely held—but a number of deltaic and floodplain surfaces formed along the border of a very active geosyncline, and intimately related to oscillations of mean sea-level during the Pleistocene. Professor Russell's analysis is worth most careful study.

Professor de Martonne presented a most ingenious morphological map of France that aroused much interest. He recommended the preparation of such a map, from large-scale contoured and geological maps, as a good method for training university students, the individual efforts being discussed in seminars before being accepted. Lastly, an excellent publication, 'Bibliographie des cartes de surfaces d'aplanissement,' presented to members, is indispensable to those investigating this branch of physical geography.

In conclusion, the remarkable enthusiasm shown in this section must be mentioned. There was no falling off towards the end of the meeting, and the erosion surfaces of the last day received as much attention as the glaciers on the first. J. H.-L.

Three subjects were discussed in *Section IIb, Oceanography*: general oceanic circulation, internal waves, and the topography of the ocean floor. Dr. Deacon gave a useful summary of Antarctic circulation based on the work of the *Discovery* Expeditions, whilst Professor Wüst dealt with the problem of Antarctic bottom water, and Dr. van Riel demonstrated the influence of bottom configuration on the properties of the abyssal layers. Professor Petterson described a boundary gauge apparatus for measuring internal waves; Dr. Fjeldstad put forward his theory of internal waves, and Dr. Lek discussed the same phenomenon in the East Indies. From observations on tidal gauges at Dunbar, Newlyn, and Felixstowe Mr. Jolly has concluded that the northern part of Great Britain is probably being elevated, whilst the southern half is being depressed.

The papers dealing with the bottom of the ocean caused considerable discussion and attracted the attention of geographers from other sections. Lieutenant Pinke's paper described the accurate determination of depth and bottom configuration, but some of the delegates suggested that it would be inadvisable to apply slope corrections until more is known about the exact

position from which the echo is returned. Lieutenant Smith described the result of the recent marine surveys of the United States Coast and Geodetic Survey, and the newly developed method (radio-acoustic rangefinding) for accurately determining the position of a ship at sea. The submarine valley charts (1 : 120,000), which will shortly be published in co-operation with the Geological Society of America, are as accurate as land maps for the major tectonic features concerned, but the contouring is perhaps a little too liberal. Among the purely descriptive papers Dr. Vaughan's deserves special attention. Three papers dealt with the geological significance of ocean-floor topography; Professor Umbgove gave a rational account of the East Indies, whilst Dr. Kuenen deplored the lack of attention given to the deeper slopes of the sea-floor on which coral reefs and submarine volcanoes rest. Colonel Seymour Sewell and Dr. Wiseman described the major oceanic tectonic features, and suggested lines upon which future work should be done in order to arrive at a satisfactory solution.

Perhaps the most significant feature of the sectional meetings was the general desire for more detailed investigations of critical areas, and the appreciation that there should be closer co-operation between the various sciences concerned if many of the oceanic problems are ultimately to be solved.

J. D. H. W.

Section IIIa, Human Geography, was presided over by Professor Biermann (Lausanne), and the three questions discussed attracted a number of papers from several European countries, the United States, and Japan. The work on the relations between town and country proved to be so closely related to the study of land utilization in Section V that a number of joint sessions were held, in addition to the separate meetings at which a number of interesting regional examples were treated. The importance of recognizing industrial districts as a separate urban group was stressed, and careful study was given to the invasion of the countryside by the town and the influence of modern motor transport. A parallel question was the advantage of combining agricultural and industrial pursuits, in which examples were discussed from the Tongking delta of French Indo-China, Japan, France, and Belgium. The main interest of these papers lay in their study of the various stages of transition in a not inevitable evolution from domestic to factory industry.

The question of migration movements attracted eleven papers varied in scope and including transhumance, movements from rural to urban areas, the penetration of the Dutch into Poland and the Lithuanians into the United States, and the modern large-scale movements of Indians and Chinese. Professor Faucher, pointing out that migrants frequently transformed the regions into which they entered, recommended wider study of the information available. The discussions of the section were lively and interesting, and it was agreed to work for a wider exchange of information and if possible to compile an Atlas of Human Geography, in the production of which a number of members offered to assist.

T. W. F.

Section IIIb, Economic Geography, met under the presidency of Professor P. L. Michotte, and was organized by Professor W. E. Boerman, of Rotterdam.

The papers submitted dealt with the industrial development of sea ports, transport, and the possibility of expressing in a more exact manner the productive value of soil and climatic factors in order to compare the economy of different areas.

The papers submitted on each of these three subdivisions, while containing much valuable material, were rather varied, and the range of subject-matter caused some difficulty in discussion. The trend of the discussions on the industrial development of sea ports led the *rapporteur* to suggest certain points requiring investigation, so that research might be co-ordinated to produce more precise consideration at the next Congress. When the transport question had been discussed, the section agreed to recommend that a Commission on Ports and Transport should be set up. It was felt that these two questions, treated separately on this occasion, should be closely related, as the suggestions made by the *rapporteur* on the industrial development of sea ports involved consideration of transport problems.

The third portion of the section's work, concerned with productivity of land, did not readily combine with the other two portions. The important contribution was Professor Ellsworth Huntington's investigation of the productivity of the soil. It may be noted here that Professor Huntington had revised the maps originally produced to illustrate his paper, and a discussion of them will be found in the *Annals* of the American Academy of Political and Social Science for July 1938.

The contribution of economic geographers in this country to the work of the section was disappointingly small. There was one paper on sea ports and one on agricultural productivity presented by British geographers. In conjunction with the attempt made at the Congress to co-ordinate research in economic geography some action to correlate investigation in this country with the conclusions of the section at Amsterdam would be welcome.

G. H. J. D.

Section IIIc, Colonial Geography, was an extremely popular one, and there were many good papers. The questions discussed were: possibilities of colonization by the white race in the tropical zone; the relation between population density and land utilization (or exploitation) in colonial regions; and the extent to which industrialization is necessary for maintaining prosperity in densely populated tropical regions.

These questions are very widely worded, and the papers submitted covered an extremely wide field. In some cases a definition of the terms employed would have been advantageous. There were several admirable papers submitted by British geographers, both from England and from the Dominions, but unfortunately their authors were not all present, and the discussion on them was limited by time. It ranged from the question of mass colonization to government by a few officials; stress was laid on the effects of climate and disease and their economic consequences; and in some cases discussion ranged beyond the tropics. It was generally agreed that colonization by well-to-do farmers assisted by native labour offered the best chance of success in the tropics. Tropical disease, owing to the advance in medicine and hygiene, was not regarded as a major problem of future colonization, but

the importance and difficulty of securing economic success in competition with native producers was emphasized. The second question brought an admirable paper on "Soil erosion" from Dr. Maclagan Gorrie, of the Indian Forest Service, and several interesting papers on similar topics relating to the Netherlands East Indies, while in dealing with the third question the experiences of several who had spent a large part of their lives in the tropics were of very great interest. In particular, the question of malnutrition of the natives in the tropical monsoon regions as the result of Western contacts was put very interestingly in a short paper by Mr. A. S. Haynes, late of the Malayan Civil Service.

Sir Richard Winstedt was president of this section, and the secretary, Professor Dr. B. Schrieke, of Amsterdam, with his assistants, had drawn up a bibliography dealing with the three questions, and had then sent out invitations for contributions from people known to be interested. This plan worked well, but probably most of those who attended this section felt that some of the discussion ranged over too great a part of the earth's surface and over too many aspects of each question. It would have been preferable to have treated each question regionally. Before the final session some members were invited by the president and secretary to discuss future policy with regard to the section. Many felt that the term "Colonial Geography" was not a good one for the range of the discussions, and there was some preference shown on geographical grounds for limiting discussion more definitely to a particular region; but it was finally decided that members had now become used to the term and that no change should be made. Four resolutions were submitted to the General Assembly, the most important perhaps being that urging on colonial governments to go ahead as fast as possible with the accurate mapping of their territories. It is difficult to study scientific questions on the inadequate maps at present available for many of the British possessions. The rapid progress shown in the accurate mapping of the Netherlands East Indies in recent years by air survey contrasts with the position in the British Empire; and some of the scientific geographical and economic investigations now being undertaken in the colonies of other Powers are at present impossible in ours owing to the lack of accurate maps. K. M.

Section IV, Historical Geography and the History of Geography, was larger and more active than at previous Congresses in the present writer's experience. It was however somewhat misnamed. The questions proposed for discussion —the history of the measurement of the earth, the influence of the Renaissance on geography and the study of Ptolemy, and disputed points in the interpretation of maps, more especially in the Age of Discovery—were exclusively devoted to the history of geography and particularly of cartography. Historical geography as understood in this country and in France found no place in the programme. This was generally agreed to be an undesirable limitation, and a resolution that this branch of study should be given due consideration in the future was unanimously adopted. The section was admirably and patiently presided over by M. Denucé, the distinguished archivist of Antwerp. It is not possible to detail here all the papers read; it may be noted however that German scholars are now at work upon a critical text of Ptolemy's 'Geography,'

and also that the study of cartographical history is being hindered by the lack of reliable reproductions, as was emphasized by Dr. Uhden and Herr Winter. It was the generally expressed hope that the Commission for the Publication of Ancient Maps would be able to commence publication in the near future. Herr Winter summarized his further researches into the problem of the oblique meridian, while Senhor Fontoura da Costa and Dr. Keuning returned to the question of the measure of the Portuguese league and the mile. M. Destombes described some interesting maps that he had found in the Top Kapu Sarayi at Istanbul, and Dr. A. Cortesão gave a brief account of the first Portuguese description of the Far East by Tomé Pires, which he has recently brought to light in Paris. Professor de Martonne presented the first sheet (Lugdunum) of the 'Tabula Imperii Romani' to conform to the recent decisions of the Commission, and Professor Blanchet reported on the archaeological map of Roman Gaul. The value of the periodical *Imago Mundi* as a link between students of historical cartography was frequently emphasized during the course of the meeting. E. G. R. T.

On the first two mornings *Section V, Paysage géographique*, met jointly with Section IIIa under the chairmanship of Dr. G. L. Pepler, of the Ministry of Health, to consider Question 2: "L'étude analytique de la structure du paysage comme base de l'utilisation du sol pour l'habitat, l'agriculture, et l'industrie." The first morning was devoted to the delivery by authors present of résumés of their printed contributions and to a general discussion; the second morning was fully occupied by a lengthy debate on the subject of five resolutions drawn up as a result of the previous day's papers and discussions.

Nineteen papers from authors representing Italy, Japan, the United States, Germany, Holland, Czechoslovakia, Britain, and Belgium were presented, but those papers (including unfortunately the American contributions) whose authors were absent were taken as read and scarcely considered in the discussion. Certain papers dealt along usual lines with the economic geography of considerable tracts—Dr. K. Kuchar (Prague) with Albania, where the regions are still almost distinct economic units, and Dr. G. Alivia with the anomalously low population of Sardinia within the kingdom of Italy, suggesting some comparisons with the Highlands of Scotland.

In the papers which dealt more specifically with the question, two matters assumed outstanding importance. One was the need for detailed scientific examination of facts as a prelude to any planning; the other was the difficulty of determining the relationship between regional and national planning. Dr. K. van Lohuizen (Dutch Institute for Housing and Town Planning) stressed the changing occupational character of the population and the strong competition between different interests for the same land—the trouble in Britain—and found much planning vitiated by the small size of the unit and the narrow views of the local authorities. Dr. Walter Geisler (Aachen) and other representatives from Germany discussed the relationship between regional and national planning. Clearly totalitarian countries regard the nation as the unit for planning, and the character of regional planning must be determined by the needs of the nation. This must apply to other countries,

and the present Royal Commission on the Location of the Industrial Population in Britain is a recognition of the shortcomings of local town and country planning.

On the following morning five draft resolutions were considered and fully discussed, four being eventually passed in a modified form for submission to the General Assembly. The varied maps exhibited the previous day led to the passing by a majority without much enthusiasm of a resolution expressing the desirability of a uniform notation for regional survey maps. Entire uniformity seems out of the question when for upwards of a century certain countries have used for forest and woodland the colour (dark green) which planners have consecrated to public open spaces; and there are many other firmly established usages. On all sides it was agreed that there should be the closest co-operation between geographers and planners, but a draft resolution that geographers should gather their material under the direction of a planner received no support.

The third and fourth resolutions arose from the exhibition and explanation on the previous day of the maps of the Land Utilization Survey of Britain. It was generally agreed that the factual information collected by the Survey was indispensable for all planning. The Dutch representatives pointed out that their official maps already showed land use, and that they regarded this as essential information on the national maps. The two resolutions read:

"It is desirable that each country should have maps showing the utilization of the land, and the preparation of the maps should be entrusted to universities having an appropriate department, assisted by government subventions."

"It is evident that in several countries the land is not put to the best use and the population has not its best distribution. This indicates the necessity for governments to facilitate the preparation and publication of survey maps proposed in the last resolution."

Certain linguistic difficulties arose, and it may be mentioned that the meeting agreed that the English "utilization" should not be translated into French as "utilisation" but as "occupation." Whilst the French "urbanism" and "urbaniste" are generally translated "planning" and "planner," doubt was expressed whether the correct translation was not essentially "town-planning" and "town-planner."

Two other questions were considered by Section V. One was "Le concept paysage dans la géographie humaine," but the three contributions, all from Germany, did not afford an adequate basis for a thorough international discussion. The other was "La conservation des beautés du paysage." Here one thing at least emerged from papers representing many points of view: the growing and now almost universal appreciation of national parks as a means of preserving the natural flora and fauna and natural beauty. Britain stands almost alone in having as yet made no official movement for the creation of national parks.

L. D. S.

Section VI, Methodology and Didactic, was well attended, and produced interesting discussions. The papers were entirely devoted to problems of teaching, and no attempt was made to treat the subject of method in geographical science in general. Two long discussions took place, the first on

geographical teaching and international relations, in which British contributors were prominent. During this discussion it was agreed to recommend the use of the International Post Office's system of town nomenclature, and where this differed from the customary usage to put the latter in brackets, *e.g.* Köln (Cologne). There was general agreement on the valuable part that geography can play in promoting understanding between nations. The second discussion dealt with the place of physical geography in the general school course; here opinion was divided, inclining to the view that it should be treated incidentally. The section was shown a new French film on "Meanders," and visited a modern Dutch school. J. A. M.

Four papers only were submitted to *Section VII, Biogeography*, of which three dealt with the present and past distributions of species in relation to the oldest geological periods, and one with the influence of man on the natural vegetation of arid regions.

One long excursion was arranged before the Congress, and a tour of the Dutch East Indies and five short excursions after its close. In addition to those described below, parties under expert guidance visited the former Zuider Zee, the mining district of Nederlandsch Limburg, and the glacial areas of Veluwe, Overyssel, and Drenthe.

The pre-Congress excursion to Zeeland was vigorously and delightfully led by Dr. Dieleman, of Middelburg, assisted by his son Dr. W. K. A. Dieleman, who acted as secretary and organizer of each day's outing. As a result a somewhat complicated programme of journeys by land and water was carried out without a hitch. At Middelburg, at Flushing, and indeed at every town that was visited, the members were officially and hospitably welcomed and entertained. It was therefore fortunate that among their number were M. Goblet and Mlle. Lefèvre, who could match eloquence with eloquence and express the feelings of the whole party. Especially memorable were the banquet at Flushing, the naval tattoo at Middelburg, and the lunch in the cloisters of the ancient abbey of the same picturesque city. Since Zeeland is mainly arable (with about 40 per cent. of small proprietors) its landscapes formed an excellent corrective to ideas based on the parts of Holland reached through Rotterdam and Amsterdam. Throughout the island of Walcheren peasant costumes are still quite commonly worn without reference to the tourist, but old buildings appear to be confined to the towns, the majority of farms and cottages being of modern construction, often of Belgian bricks and roofed with Belgian slates. Among points to which special attention was drawn was the question of water-supply, which to the south of the western Scheldt is pumped out of the tertiaries, here not far from the surface, and distributed from lofty water-towers. Elsewhere it is obtained from the dunes, which at a certain depth are saturated with the infiltrating rain-water: very delicate adjustments are necessary to avoid tapping the saline water at greater depths. The dunes occur in very restricted situations, and it is remarkable to see the abrupt change of the sea defence from dune to dyke. Some members of the party took a short air flight which enabled them to see the whole lay-out of a dune field in relation to the wind control, and the

methods adopted to fix the shifting sand by planting. Farmhouses behind the dunes are deeply buried in wind-breaks of trees and shrubs. The construction of the dykes was examined at several points: massive as they are, with their footing of basalt blocks, it appears that breaches still occur, sometimes by a sudden subsidence. The burden of taxation which the polder must bear to maintain the dyke is a heavy one. E. G. R. T.

A small party visited the dunes and polders, and a close study was made of the Haarlem polder under the direction of the chief engineer, Dr. Bijl. The wide diversity of the terrain and land utilization was of exceptional interest. Dr. Tesch, Director of the Geological Survey of the Netherlands, was with the party for three days, during which the prehistoric and post-Roman dunes were examined. On the last day the island of Texel was visited; here a morainic surface formed the nucleus around which sand dunes have developed and a number of polders have been constructed. T. W. F.

The excursion to Rotterdam and its environs, led by Professor W. E. Boerman, was designed to emphasize the great variety in the economic, industrial, and agricultural activities of the region. On the first day the party travelled through Delft to the horticultural district of Westland, sometimes known as "Glassland" on account of the profusion of glass-houses. At Honselersdijk they saw an auction of cut flowers in the co-operative building, and at Poeldijk an auction of fruits—grapes, peaches, tomatoes, etc.—in a hall to which the produce is conveyed directly by boat. They also visited the vine-houses on a large property in the neighbourhood. The growing of grapes was introduced in the seventeenth century, but the use of artificially heated glass-houses is a comparatively recent development, favoured by the proximity of large markets in Holland and abroad. The experimental gardens at Naaldwijk are a further development in co-operation. After visiting the Hoek van Holland and the entrance to the Nieuwe Waterweg a visit was paid to Vlaardingen, where the party was entertained by the Chamber of Commerce in the Handelsgebouw, which houses the herring market and an interesting fishery museum. Vlaardingen, formerly the chief centre of the herring trade, has suffered a considerable decline through political developments in recent years, but fresh markets are being successfully developed in the United States and the East Indies.

The greater part of the following day was spent in a cruise through the docks and the Nieuwe Maas as guests of the port authorities. The characteristics of the port—deep waterways with unrestricted access to the sea, specialization of the various docks, facilities for rapid loading and unloading, and the organization of the Rhine traffic—were well displayed. A recent development is the encouragement given to the traffic in diversified small bulk cargoes, a measure taken to relieve unemployment. Visits were then paid to the housing estates and blocks of flats which are a feature of the recent development of Rotterdam. As the city planning exhibition, "Ontdek uw Stad," carried out under expert direction by unemployed youths, demonstrated, much thought is being given to the future growth of the Rotterdam–Schiedam area, for which an ultimate population of one million is anticipated. On the final day an excursion was made through the region of the Lek and the "waarden," lying east of Rotterdam, as far as Vianen. This area of

polders, chiefly devoted to dairy-farming and pig-raising, presents a sharp contrast to Westland, as also does the island of Ijsselmonde, an agricultural and horticultural district, where glass-houses are not employed.

During the visit the party was most hospitably received by various public bodies; in particular the Municipality of Rotterdam gave an informal reception for them in the spacious and well-arranged galleries of the Museum Boymans.

G. R. C.

THE R.G.S.II SYSTEM FOR THE TRANSLITERATION OF RUSSIAN AND THE TREATMENT OF CONVENTIONAL NAMES

THE abolition of the letter ѣ, the use of e in its place, and the common Russian habit of omitting the diaeresis from the letter ё have led to clerical and phonetic difficulties in dealing with transliterated Russian geographical names. The P.C.G.N. therefore collected the views of a number of authorities on Russian, and considered them at a meeting held on 29 June 1938.

According to Professor S. Boyanus (*Slavonic Rev.*, 13, No. 38 (1935) 413–419), the presence of a vowel-glide, *y*, between vowels and the palatalization of consonants before back as well as front vowels are characteristic features of the Russian language. The principal Russian vowels fall into a so-called "hard" series, а, э, о, у, ы, pronounced *a*, *e*, *o*, *u*, *ĭ*, and a corresponding "soft" series, я, е, ё, ю, и, pronounced, in isolation, *ya*, *ye*, *yo*, *yu*, *i*. When я, е, ё, ю occur initially, or after vowels in the body of a word, they represent two elements, the front vowel-glide *y* and the corresponding hard vowel а, э, о or у, that is, they are pronounced *ya*, *ye*, *yo*, *yu* in these positions also. In view of the simplicity of this relationship, the P.C.G.N. has decided that the letter е shall be transliterated by *ye* initially or when it follows a vowel, and that the letter ё shall be transliterated by *yo* in the same circumstances. Owing to the exclusive use of *y* as a consonant in the R.G.S.II System, it was decided not to transliterate the vowel ы by this letter.

By palatalization is meant the imparting of a liquid quality to the sound of a consonant by momentary contact of the tongue with the hard palate, *e.g.* *d* in *d*'you, *l* in rebel*l*ion, *n* in *n*ew, pi*n*ion, *r* in cla*r*ion, *t* in *t*une, etc. In the Serbian form of the Cyrillic alphabet, palatalized *d*, *l*, *n*, *t*, are provided for by the letters ђ, љ, њ, ћ, which are transliterated by *dy*, *ly*, *ny*, *ty* in the R.G.S.II System, except at the ends of words, where they are rendered by *d*', *l*', *n*', *t*'. In the Great Russian alphabet there are no separate letters for palatalized consonants. Palatalization is merely indicated by the presence of the soft mute, ь, or one of the so-called "soft" vowels, я, е, ё, ю, after the consonant. The latter device is misleading, even to Russians, many of whom do not understand that in such syllables as тя it is only the consonant which

is affected. The sound produced by palatalization is similar to but so much lighter than that of the vowel-glide that L'eningrad is, phonetically, a better form of transliteration than Lyeningrad, Od'essa than Odyessa, etc. But as the apostrophe is reserved for the transliteration of the soft mute, which is not present in such words, and the Russian vowel-letter is that of the soft vowel, it has been thought better to adhere to letter-for-letter transliteration than to introduce a special device to indicate the palatalization of consonants. It has been decided therefore to transliterate the letters e and ё by *ye* and *yo* respectively after palatalized consonants. The result will be consistent with the R.G.S.II transliteration of Serbian. The consonants ж, ч, ш, щ are not palatalized.

In accordance with these decisions, and a decision of 24 November 1937 (see *Geogr. J.*, 91 (1938) 159), the table for the transliteration of Russian appearing on pp. 37–39 of the *R.G.S. Technical Series: No.* 2. Alphabets of Foreign Languages, by Lord Edward Gleichen and John H. Reynolds; Second Edition; London, 1933, should be amended as follows:

Russian characters		*Translit.*	
Е	е	ye, e	ye initially, after the palatalized consonants, and after a vowel. The y sound is absorbed by a preceding ж, ч, ш or щ: Чернышев, pr. Chernishef.
(Ё)	(ё)	yo, o	yo initially, after the palatalized consonants, and after a vowel. The letter ё is usually stressed, but the diaeresis is omitted by most writers: Петр, Кишинев, pr. Pyotr, Kishinyóf. (Also used for rendering German ö.)
Ж	ж	zh	Pronounced as French j (*v.* R.G.S.II. Rules, p. xiv): Жмеринка, Джульфа, translit. Zhmerinka, Dzhul'fa. (English j is rendered by дж.)

These, and other changes rendered necessary in the *R.G.S. Technical Series: No.* 2, will be announced in a short appendix to that work now in preparation.

The slight changes involved in this revision of the R.G.S.II system for Russian raise the perennial question of conventional names. It should be observed that in the case of independent countries which use forms of the Roman alphabet, conventional names are rapidly falling out of use in favour of local official names, which in most instances are also native names.

In the case of mandated territories and foreign colonial possessions, in all of which, except those of Japan, the Roman alphabet is official, the problem is effectively met by the P.C.G.N. decision to accept the local official name, which involves acceptance of foreign transcriptions of native names (*e.g.* Beyrouth, Djebel Drouz) and, unfortunately, the acceptance of a certain number of foreign conventional names, *e.g.* Damas for Esh Sham (Damascus). It is hardly conceivable that Europeans will readily give up the popular use of their particular forms of such conventional names as Damascus and Jerusalem unless independent native action eventually imposes the use of the native names. In such instances therefore the P.C.G.N. proposes to

recognize the better-known conventional names in English use, though many of them are English only by adoption. Most of them will appear in the Committee's lists only as prominent cross-references to their official forms. The policy of the Committee is gradually to discourage the use of conventional names.

Certain independent countries which use non-Roman alphabets or scripts also make subsidiary official use of the Roman alphabet, *e.g.* Egypt, China. The Survey of Egypt issues both Arabic and English editions of some of its maps. Names such as El Qâhira and Iskindirîya on the former appear as Cairo and Alexandria on the latter. The Arabic and the conventional English forms are both official. Both forms have therefore to be recognized, but the conventional name will be relegated to a cross-reference.

Names in independent countries which do not use the Roman alphabet at all, *e.g.* Russia, Greece, Iran, have all to be transliterated or transcribed, and, strictly speaking, all transliterated names are conventional. Certain forms of these names, as for instance those which appear in the *Dictionnaire des Bureaux de Poste*, 4th ed., Berne, 1937 (*e.g.* Kaboul, Piréefs, Tcheliabinsk, Téhéran), have the sanction of limited international use. Others have the advantage of being the same in several languages (*e.g.* Leningrad is English, French, and German). The priority of international forms has recently been recognised by the International Geographical Union (*Petermanns M.*, 84 (1938), 277). Others again are purely national (Djidda, Dschidda, Gidda, Jidda). There is no generally recognized order of priority among such transliterated names. Obviously the wishes of the countries concerned are entitled to first consideration, and the International Map Committee of 1913 invited such countries to Romanize their alphabets and scripts. The International Geographical Union has recorded its approval of the "Nippon-siki" system for the official Romanization of Japanese (*Congr. Internat. G.*, Paris, 1931, *C.R.* 3 (1934) 754–756). Unfortunately the official systems of Romanization developed in Japan and Russia have not been phonetically satisfactory from the English point of view (see *Geogr. J.* 91 (1938) 158–159), and Romanization is still on trial.

The present choice, in this case, is between the postal guides and national systems of transcription. The P.C.G.N., having derived its information from the best available sources, considers that its own transliterations are, for the time being, the best for British use. It is proposed to list transliterated names, in independent countries which do not use the Roman alphabet, under their more familiar forms, giving improved transliterations in brackets after them, and current but unsatisfactory transliterations only as cross-references.

Lastly, there is the question of conventional names on frontiers. Many frontier features have two or more official names of equal standing. It is more convenient to refer to Lake Okhrida than to make an arbitrary choice between the Albanian, Greek, and Serbian forms of the name. It is proposed therefore to recognize English conventional names on frontiers if they make for ease of reference.

The manner of listing conventional names belonging to the five categories discussed above is illustrated by the following examples:

1. Durazzo: Ital.; Alb. DURRËS, *q.v.*
2. Beirut: Engl.; Fr. off. BEYROUTH, *q.v.*
   DAMAS (*prop.* Esh Sham): (particulars follow).
   DAMASCUS: Lat. and conv. Engl.; Fr. off. DAMAS, *q.v.*
3. CAIRO: conv. Engl.; Ar. EL QÂHIRA, *q.v.*
4. KANDAHAR (*more correctly* Qandahar): (particulars follow).
   ODESSA (*more correctly* Odyessa): (particulars follow).
5. Okhrida, Lake: conv. Engl.; see LIMNE AKHRIS.

E. D. R.; M. A.

STRUCTURE AND FLOW OF GLACIER ICE: A REVIEW

THE REVEREND W. L. S. FLEMING

WITH the foundation last year of the Association for the Study of Snow and Ice a start has been made in this country to encourage interest and research in glaciology. This aim is important in view of the increasing number of expeditions which leave this country each year for the Polar regions. These could carry out more useful work if the knowledge of the science and its field technique were more readily available and understood. At the meeting of the Association on 16 December 1937, a discussion on the structure and flow of glacier ice was opened by Dr. Leonard Hawkes, and eight members took part. Some written comments were afterwards received from Professor Dobrowlski. The following account is based upon the remarks of all the speakers, though it has not been possible to acknowledge every individual contribution in the text. Use has also been made of the minutes kept by the chairman, Mr. Gerald Seligman.

In introducing the discussion, Dr. Hawkes referred to the paper he published in 1930 (*Geol. Mag.*, 1930, pp. 111–23), which, it may be noted, is one of the few significant contributions to the knowledge of glacial processes which have been made in this country recently. He pointed out that flow in ice will take place only under non-uniform or directed pressure, and its mechanism appears to be the same as that of solid flow in other rocks or metals. When the stress is suitably directed, fracture takes place with slip and subsequent regelation along the basal glide planes of the closely fitting ice crystals of the glacier.

The crystals of which glacier ice consists have generally been assumed to lie at random orientation, but observations made by Mr. Perutz on the Lower Grindelwald glacier, though requiring confirmation, would lead one to doubt this. He believes it likely that the crystals are orientated in such a way that the basal glide planes are commonly parallel to the direction of glacier flow; and that under the conditions of stress and readjustment of the grains in the glacier, the growth of crystals with such an orientation is favoured at the expense of others. The tendency towards a uniform orientation of the ice crystals had been enunciated by Drygalski in the glaciers of Greenland[1] and of the Antarctic, and by Sherzer in the glaciers of the Canadian Rockies and Selkirks, but without definite verification (*Smithsonian Contribn. to Knowledge*, 34, 1907). Tammann's general theory of recrystallization, as applied to the grains of a

[1] E. von Drygalski, 'Die Struktur des Eises . . . Groenland-Expedition, 1891–93,' I, 1897; 'Deutsche Südpolar-Expedition, 1901–03, I, 1920.

glacier, involves a like tendency ('Agregatzustände,' Leipzig, 1922, 214–5). Another type of movement may be supposed to occur at the junctions between the crystals, whenever the temperature is near the melting-point, so that the force binding crystal to crystal is weaker than the internal cohesion. Such movement may also occur at lower temperatures due to the presence of liquid brine at the inter-granular boundaries. Brine is said to exist in appreciable quantities in glacier ice at temperatures above −21·72° C. Dr. Hollingworth remarked that in glaciers where there was heavy ablation, there would tend to be a cumulative increase in the brine content which would render this factor in glacier motion more effective.

A question as to whether water in the glassy state might not also exist at the intergranular boundaries was raised. Dr. Hawkes (*Nature*, 124 (1929) 225) had succeeded in preparing what appeared to be solid and amorphous droplets of glassy water at a temperature of −22° C., and Beilby had previously recorded the preparation of the same substance at −12° C. ('Aggregation and flow of solids,' Macmillan, 1921, 194–200). When touched by a needle, the droplets appeared to be solid and crystallized with an audible click. However, as the crystallization velocity of the droplets was so high, it is possible that the impression of their being solid was a false one and that they may have been droplets of super-cooled liquid. In any case vitreous water could not exist at the intergranular boundaries, for as Dr. Desch contended, it would crystallize instantaneously in contact with ice. The existence of vitreous water would thus seem to be irrelevant to processes of glacier movement.

Instances of a spasmodic or jerky movement of glaciers have a bearing on the problem as to how far melting by directed pressure plays any part in promoting glacier motion and how far motion is differential. Washburn and Goldthwait (*Bull. Geol. Soc. America*, 48 (1937) 1653–64) have found that on the South Crillon glacier, Alaska, movement at the surface appears to take place by small instantaneous spasms occurring at least once every twenty minutes. On a small scale such jerky movement is also suggested by the observations on the Hintereisferner glacier made by Weinberg (*Ann. der Physik*, 18 (1905) 81–91, and 22 (1907) 321–32). Such discontinuous motion throws doubt on hypotheses involving pressure melting, and provides evidence for a relative motion between the grains as distinct from deformation of the grains themselves. The close dovetailing of the crystals in the snout of a glacier (particularly in its lower layers) might disfavour their differential movement, which however might still apply to the upper part of a glacier snout such as that of the South Crillon glacier. Hamberg had calculated that in the Mikka glacier, where the movement was 30 m. a year and the depth 100 m., a complete rotation of the grains once in ten years would suffice to account for their speed, so that the very slightest differential movement of the grains might in truth be one of the principal causes of glacier movement.

Dr. Sandford suggested that jerky movement may be interpreted as taking place along thrust planes, whenever the potential energy accumulates sufficiently to overcome inertia along defined lines of weakness or sliding, perhaps with accompanying regelation. In the case of Washburn and Goldthwait's experiments, the jerky motion was observed at the snout of a much-crevassed glacier and might be interpreted as the movement of an upper crevassed portion of the glacier, moving jerkily and apparently rhythmically over a core of smoothly flowing ice. In the case of the Upper Rakhiot glacier, Finsterwalder (*Zeits. Ges. Erdkunde*, Dec. 1936) had found that the glacier was moving as a single block, but this case where differential flow does not take place has presumably arisen under particular and perhaps peculiar local conditions.

Any theory of glacier motion must take account of the differences which generally prevail between the surface zone of the glaciers and the underlying ice. Clearly the superficial portions of glaciers are more rigid and yield principally by shear. Washburn and Goldthwait (*Bull. Geol. Soc. America*, 46 (1935) 1883, and *G.J.* 87 (1936) 508) estimate the depth of this rigid zone in the South Crillon glacier to be 60 m. Below the upper crevassed portion, Professor Hess has pictured a zone of flow, consisting of homogeneous ice flowing smoothly at its pressure melting-point. The banded and contorted structural pattern of glacier ice in the region of wastage would certainly seem to have arisen under conditions of plastic flow in which the ice had participated when it was farther up the glacier and more deeply covered.

With regard to fracture, which belongs especially to the surface and more rigid zone of glaciers, Dr. Desch pointed out how in metals fracture under stress may take place either through the crystal grains or along the crystal boundaries, according to the speed of fracture and the temperature. Slow fracture at low temperatures and rapid fracture at high temperatures are most apt to cause fracture between the crystals, whilst a sudden fracture at low temperatures would occur through the crystals. In the light of such facts, it would be interesting to know whether in the production of a crack in the ice leading to crevasse formation, the fracture occurs between the crystals or along the basal glide planes within them. In a small section cut in the Hintereisferner glacier Weinberg had found that fractures between the grains occur as often as those through or across them. In this case the observations show that the cohesion of ice in a glacier is as feeble as the mutual surface of contact between the grains, and this in turn shows the possibility of a relative movement occurring between the grains.

O. D. von Engeln (*Geogr. Rev.*, 27 (1937) 478–82) has often argued that the essential characteristic of glacier motion is plastic flow and that all the ice with the exception of the rigid shear-yield crustal part partakes of such a movement. Perhaps the most important recent contribution towards an understanding of the nature of motion of this interior and presumably plastic zone was made by Otto Flückiger (*Petermann's Mitt., Erganz.*, No. 218), to which Mr. Odell referred. Flückiger,[1] believes that glacier ice (with the probable exception of the rigid upper ice) partakes of a wave motion. The origin of this wave motion he refers to the principle that where mediums of different densities move past one another along a surface of contact, a wave development occurs at the contact plane. The wave motion is believed to have full development at the bottom of the glacier and to impinge on the rock floor, evidently without being sensibly damped out by the more viscous debris-laden bottom layers of the ice. Roches moutonnées Flückiger interprets as moulded by the wave train of the ice. Thus, contrary to previous views, Flückiger and von Engeln would hold that the production of roches moutonnées is not primarily governed by the form of the pre-existing surface, nor by the rock structure; roches moutonnées rather are a normal characteristic of glacier erosion and thus not a transitory stage but the end term of a region invaded by ice. Von Engeln (*op. cit.*, 1938, 426) emphasizes the full geomorphological implication of Flückiger's theory and comes to the conclusion that glacial processes have potency to act " with ultimate complete indifference to all variations in rock structure." According to this view, a glacier creates a landscape *sui generis*, independent of pre-glacial relief and reflecting the underlying hard rock structure only in detail.

[1] A paper by O. D. von Engeln entitled "Glacial geomorphology and glacier motion" (*American Journal of Science*, Vol. XXXV, 1938, pp. 426–440), gives a clear summary of Flückiger's views and stresses their geomorphological significance.

Professor Dobrowlski, in a written communication, pointed out that the different theories which have been put forward concerning the mechanism of glacier motion often depend on hypotheses concerning the structure of the glaciers, and that they are not scientific theories in the proper sense of the term, but assumptions lacking experimental proof and devoid even of adequate theoretical justification. In view of this he urged the need for more experimental work and suggests two lines of approach that would prove profitable. In the first place he suggested comparing the coefficient of viscosity of glacier ice, by taking samples from grains of different sizes, with the mean coefficient of viscosity of individual grains (or, if that would be too difficult, of crystals of freshwater ice) by deforming these in different crystallographic directions. This would show whether or not the viscosity of glacier ice depends on the size of the grains and whether glacier ice is less viscous than the grains of which it is composed. If the smaller crystals are found to be less viscous than the larger ones and the glacier ice to be less viscous than the isolated crystals, then one would be forced to admit that the movement of the glacier takes place not only by the deformation of the grains but also, to a degree dependent on the size of the calculated difference, by a relative movement between them. Only when this had been determined would one be in a position to inquire how far the relative movement of the grains will be facilitated by, or even dependent on, the presence of brine between them. In carrying out these experiments it would be necessary to take into consideration the speed of deformation and to bear this in mind when defining the coefficient of viscosity. Furthermore a comparison between the speed of deformation of a grain of glacier ice and that of the purest freshwater ice crystal would show whether or not the glacier grain is "dry" or "wet"—that is to say, whether the movement is or is not facilitated by almost imperceptible layers of solution lying within the glacier grains perpendicular to the optic axes of the crystals.

The second suggestion made by Professor Dobrowlski was to find out to what extent gliding movement takes place in a glacier along the planes of stratification. Previous experiments have been carried on over too short a period, and it would be necessary to make a sufficient number of observations over a longer period in order to find out how much relative movement there is between the strata.

In order to verify any mathematical theory of the dynamics of glacier movement, one needs to have sufficient soundings to give the profiles of a number of glacier beds; the distribution of temperature within the interior of glaciers; the laws of vertical distribution of rate of motion; the distribution of rate of motion at the surface; and the coefficient of viscosity of glacier ice. Until sufficient quantitative data of such a kind are available, no scientific theory of glacier movement can be propounded.

A different line of approach is afforded by the structure of certain glacial deposits. Dr. Slater drew attention to the evidence given by the structure of the Ipswich beds in which plastic and non-plastic lenticles derived from local outcrops, and associated with glacial sands, gravels, and boulders, are incorporated as englacial debris and have been moulded into the forms they now assume by the viscous flow of the ice. The drumloidal streamline forms of the deposits have been shown by experiments to bear striking resemblance to the flow curves assumed by any contaminated plastic or viscous substance upon cessation of movement. The morphological structure of the Hadleigh Road area of Ipswich, Dr. Slater interprets as a glacial pseudomorph or fossil glacier, the interstitial ice having been removed under pressure as films of water (*Proc. Geol. Ass.*, 38 (1927) 157–216). Much more impressive examples in

Britain are the Bride Moraine of the Isle of Man and the Cromer Moraine of Norfolk.

In a recent paper (*Journal of Geology*, XVI, 1938, pp. 700–25) Max Demorest shows how the orientation of glacial striae provides evidence of the nature of glacier motion. By the use of this criterion he maintains that ice under sufficient pressure flows in response to the laws of fluid mechanics, and estimates the least thickness of solid ice necessary to cause such flow as close to 150 ft., corresponding to a pressure of 4 kg. per sq. cm.

Another geomorphological aspect of the problem is posited by the increasing number of instances which are being brought to light of glacial deposits laid down in association with ice wasting in a stagnant condition.[1] Glaciological research should now reveal fresh information on the limiting conditions under which glaciers cease to move.

Geological evidence, while it may be expected to furnish qualitative data concerning the structure of glaciers and the effects of their movement, cannot yield the empirical basis which glaciological research may provide. Research along the lines indicated by Professor Dobrowlski would do much to afford a better understanding of the processes involved in glacier motion, and to give the geologist more reliable evidence on two problems about which many different ideas are held at the present day, namely the physical conditions under which certain glacial deposits have been laid down, and the efficacy of glaciers to erode.

[1] See, for example, Flint, "Stagnant ice as a factor in the genesis of glacial deposits" (*Zeits. für Gletscherkünde*, Bd. XX, 1932, 455–70).

REVIEWS

EUROPE

COMPANION TO TWEED. By GEORGE BURNETT. *London: Methuen and Co.*, 1938. $7\frac{1}{2} \times 5$ *inches;* xii + 302 *pages; illustrations.* 8*s* 6*d*

Mr. Burnett claims, apparently, to be of those "who get the past and present in equipoise" (p. 114) in the sense of giving equal weight to what is, strictly, seen by the eye and to what is added by memory and the emotions. For the Scottish Borders this is a very large claim. Over every Border scene memory throws too close a web of poetry and legend for the eye to see it easily at all, apart from its associations. Moreover, the upland scenery, the most distinctive of the Borders, is set usually in a minor key, with a delicate and elusive charm quite discordant with the emotions roused by associated tales of violent deeds. It is much to ask of an author that he shall give due value to the scenery both of upland and of dale, and discriminate nicely among the strands of the overlying web. Mr. Burnett has the primary qualifications for his task of being well versed in Border lore and a whole-hearted lover of Border scenery. But he gives the impression of not being quite himself above the tree-line and his ear is, curiously, more responsive than his eye until he reaches the human warmth of domestic valley scenery.

What is freshest and best in Mr. Burnett's book is his account of Border "popular customs." Here past and present are really in equipoise, in a different sense, by the holding of a just balance between the truly traditional and the modern accretion or revival. A Teri will grumble however that the Hawick slogan is less likely to be the fragment of a pagan prayer to Tyr and Odin (as Mr. Burnett says) than of a Cymric hymn marvellously anticipating "Land of hope and glory." Again, it is literally true of course that Jedburgh is "now the only town in Britain to . . . play . . . handba' on Candlemas Day" (p. 261), but the Fastern's E'en ballgame, which is not mentioned at all though still played at Hawick and elsewhere, is equally typical of the rude vigour of modern corporate life on the Borders.

Of modern life in its everyday garb, vignettes are given which vary in quality from a very good description of the life of the Tweeddale shepherd to an amazingly banal account of a wet day at Kelso, which would apply equally to a wet day almost anywhere else in these islands.

On the whole, this is a competent, but certainly not an inspired, companion to Tweed. R. A.

THE VERGE OF LAKELAND. By WILLIAM T. PALMER. *London: Robert Hale*, 1938. $7\frac{1}{2} \times 5$ *inches;* 288 *pages; illustrations and sketch-map.* 7*s* 6*d*

Unlike many writers about this famous countryside, Mr. Palmer is no mere "offcome," who has written about his subject by lifting matter from all and sundry guide-books. He has his roots deep in its soil and knows not only its outward look but its inner and intimate life. His book is pleasantly written and covers the valley of the Lune and its neighbourhood, the Howgill Fells, and all that land embraced by the name of Edenside. It is a countryside which is well documented, from the ponderous Nicholson and Burn or the 'Survey' of Clarke to such a rare little book as Mr. Nicholls' 'History and traditions of Ravenstonedale.' All this wealth of matter coupled with Mr. Palmer's keen eye for country and for country life has enabled him to write an account which must appeal to all who love this neighbourhood. Although it is not a guide-book,

parts of the routes described are so detailed that one would like to follow them on the map. The latter however is inadequate and merely shows the outlines of the country described. The division into sections dealing with a diversity of places and people and country lore leads occasionally to slight repetition. The book is well produced and illustrated. T. H.

TWO IN A VALLEY. By STEPHEN GWYNN. Illustrated by ROY BEDDINGTON. *London: Rich and Cowan*, [1938]. 10×7½ *inches; 84 pages; illustrations.* 7*s* 6*d*

Mr. Gwynn has written a simple and brief account of his wanderings in the Coln valley in the Cotswold country, in what he regards as "quintessential England." Not everyone would accept that description of it, but few would deny the charm of Cotswold stone. The book is amply illustrated by Mr. Beddington. The black-and-white sketches in the text are perhaps more successful than the rather formalized paintings, where the bleakness is not always that of the Cotswolds.

GOLDEN GUERNSEY. By ALFRED S. CAMPBELL. *New York: David Kemp & Co.*, 1938. 8½×5½ *inches; 298 pages; illustrations.* $3.00

The author of this pleasant book is an American who became so interested in the Guernsey cattle on his own farm in New Jersey that he resolved to see for himself their home in the Channel Islands. There he fell in love with Guernsey and its people, and collected a great deal of interesting and amusing information.

Concerning the origin of the Guernsey breed of cattle he tells us that about A.D. 960 a band of monks from Mont St. Michel brought to Guernsey a small red breed of cattle known as Froment de Leon. Some years later these monks were joined by others from Cherbourg, who introduced the large brindled breed known as Isigny. From the continuous crossing of these two breeds was evolved the famous Guernsey type.

In Guernsey nowadays most people speak English, but a patois of Norman French is commonly spoken, and the official language of the Courts is French (though English is also used). The patois must soon disappear and it would be interesting to know what attention, if any, it has received from trained phoneticians. A comparative phonetic study, indeed, of all the dialects of the Channel Islands would be work of permanent value.

Guernsey, of course, has its own constitution and its own laws and customs, and as long ago as 1680 these were well described by Lord Hatton. In pointing out that Guernsey was independent of the jurisdiction of English Courts, Lord Hatton then remarked that "whoever shall call it part of Hantshire do grossly erre from the truth." Mr. Campbell has a good deal to tell us of the old customs and of seigneurial rights.

In bygone days, especially during the latter half of the eighteenth century, much of the prosperity of Guernsey was built up on the smuggling of spirits into England. Among other items of interest there is a first-hand description of Victor Hugo, who lived on the island from 1855–1870. There are some inevitable remarks on the rapid spread of glasshouses for the cultivation of tomatoes, which all lovers of beauty deplore. Mr. Campbell considers them a serious threat to pasture land, and observes, not without bias, that while tomatoes can be grown anywhere there is only one breed of Guernsey cattle. C. K. M.

LE RELIEF DE LA BELGIQUE. By CH. STEVENS. (Mémoires de l'Institut Géologique de l'Université de Louvain. Tome XII.) *Louvain*, 1938. 12×9 inches; *Texte* 37+428 *pages; Planches* XXI (*separately*), *together with other illustrations and maps*

Those geographers who open this very considerable monograph on the "Relief

of Belgium" and expect to find systematic descriptions and authoritative pronouncements upon such matters as the denudation chronology of Belgium, the evolution of the Belgian drainage system in plan and its relations to the lithology and disposition of the underlying rocks, or the characteristic morphological features of the numerous minor regions which are so clearly developed there, will surely be disappointed. If they are wise enough and patient enough to read its four hundred or so pages they will glean a great deal of information upon these and other such topics, but they will discover that M. Stevens understands the term relief in a sense at once wider and more restricted than that which is generally current. This he makes clear when he frankly says (p. 40), "quand on lira ce mémoire, on se dira qu'il aurait pu s'intituler; 'L'influence de la Tectonique sur la morphologie belge' ou 'L'orientation de l'érosion en Belgique dictée par la Tectonique.'" And to this end he brings together a wealth of argument which cannot, it is true, command assent at all points, but which cumulatively goes far to prove his thesis.

M. Stevens is led to conclude that all Belgium, even including the high plateau of the Ardennes above 2000 feet, was overspread by a late Pliocene sea and that the present rivers and visible features of relief are not older than the period of its withdrawal. The rivers that appeared at that time—Yser, Lys, Escaut, Dendre, Senne, Dyle, Gette, and the Maastricht Meuse—later suffered modification during a period in which the surface was deformed by the renewed uplift of the Ardennes and other tracts, and the renewed depression of the troughs of the Haine and the Sambre-Meuse, the latter movements initiating the rivers of the same names. The Dinant Meuse and the Tournais Escaut, he holds, maintained their antecedent courses across these upwarps; the Yser had its back broken by the rising of the axis of Thourout. These late deformations are shown to be intimately related to the cumulative warpings revealed by the present "relief" of the buried Palaeozoic floor in Brabant, Hainault, and Flanders, and in some cases to structures in the floor itself. They continue in fact a history of repeated movement which is evidenced at the present day by the excessive accumulation of river alluvium in certain of the downwarped tracts.

M. Stevens' affirmation of the widespread nature of the Pliocene transgression in Belgium, and of its importance in relation to the epigenetic drainage system which arose during the ensuing emergence, is to be welcomed. Dr. S. W. Wooldridge and the reviewer have recently advocated a similar history for much of south-east England, but as a result of their work they would doubt whether the transgression in Belgium ever submerged the land which is now above the 200-metre contour; they thus range themselves with those Belgian workers who have brought forward evidence for believing the Ardennes to have escaped submergence. It follows from this that the reviewer finds himself in disagreement with M. Stevens' views as to the origin of the Dinant Meuse and its supposed capture of the Upper Meuse at Mézières.

Every worker in this country will envy M. Stevens the ample space in which he is able to express his views, the profusion of text-figures, and the magnificently reproduced collection of plates, mostly excerpts from the 1/20,000 topographic map contoured at 1-metre intervals, by which his text is illustrated. D.L.L.

IN PRAISE OF SWEDEN. By MAXWELL FRASER. *London: Methuen & Co.*, 1938. $7\frac{1}{2} \times 5$ *inches;* x+316 *pages; illustrations and railway-map.* 7s 6d

It is difficult to imagine to what public this book will appeal. It is not a book of genuine personal impressions and experiences, nor yet a straightforward guide-book. With infinite pains Miss Maxwell Fraser takes us province by

province, town by town, village by village from Skåne to Lapland. At each stop, and they are legion, she tells us something of the geography, history, archaeology, and architecture, and generally manages to introduce references to art and literature as well. Nothing is arranged in any kind of intelligible order, but facts are imparted in a haphazard manner which may be intended to relieve them of "heaviness."

Embedded in this mass of unretainable facts there are some pieces of useful information, but often enough Miss Maxwell Fraser is a misleading guide. In not less than a lifetime of travel and study could any one person have dealt adequately with what is attempted in her book. As it is one cannot but suspect that she has never seen half the places she mentions, and that most of her information has been collected from the most readily available but not necessarily most trustworthy sources. It is also significant that not one of the photographs in the book is her own.

No country is more deserving of praise than Sweden, but undiluted praise as applied by Miss Maxwell Fraser makes it seem so dull that not a few of its admirers will wish that she could have praised less heartily, or at least with a more restrained and varied use of adjectives. M. S.

EISENBAHNGEOGRAPHIE JUGOSLAVIENS. By FRIEDRICH MARTIN. *Würzburg: Konrad Triltsch*, 1937. 8½×6 *inches;* vi+90 *pages; maps and diagrams*

This little monograph will prove of interest to the specialist in railway geography, and to some extent to the general reader, though both will probably be irritated to discover that the four large folding-maps give no clue to the profusion of place-names mentioned in the text. If "maps are the geographer's most characteristic way of expressing geographical facts and factors," then a great opportunity has been lost, since the maps suggest no correlation of railway development with physical features, nor with such important factors as density of population. If this lack were due to an urgent need for economy, it might be excusable, but the facts of the large coloured map showing administrative divisions could just as well have been expressed by a small black-and-white diagram, and the money so saved devoted to a map showing relief and place names.

These considerations apart, the monograph gives a clear account of the initiation and growth of the railway net of Yugoslavia and of its present economic importance, together with an indication of future lines of development. Even to-day Yugoslavia is only sparsely provided with railway lines, except in the north of the country, and can hardly be said to have a complete net or system of railways. Development was hindered at the beginning of the railway era by the greater part of the area being under Turkish rule, and later by its division among several countries, whose mutual hostility or suspicion caused railway lines to be built for strategic rather than for economic reasons. The physical obstacles due to difficult relief also played a great part, and so too did the lack of capital, both in old Serbia and modern Yugoslavia. The progress made since 1918 has been very considerable, especially in Macedonia, western Serbia and the north-west part of the Dinaric mountain system. M. R. M.

IN GREECE, with pen and palette. By ZABELLE C. BOYAJIAN. *London:* J. M. DENT & SONS, 1938. 9×6½ *inches;* xii+206 *pages; illustrations and route-map.* 15*s*

A decade has gone by since Miss Boyajian made the first of the two visits to Greece which she describes in her book, and the intervening years have mellowed

rather than dimmed her impressions, giving unity to her portrait of a land in which past and present equally appeal. She was too much versed in the classics to disregard the attractions of Athens and Delphi, Mount Parnassus or Olympia; then from Patras she went to Missolonghi, and finally to Ithaka. Her second visit had for its occasion the centenary of Greek Independence, and began again at Athens. She went to Ægina, and then to the Peloponnese, to Mykenae, Tyrins, and Sparta. In a book such as this however the writer's frame of mind is of more importance than the places actually visited; a mere list hardly conveys her obvious liking for the people who now dwell in them. The water-colours with which the book is illustrated show that the author was as sensitive to the beauties of the Greek landscape as to the seas of ruins which are for some its only attraction. J. P. H. M.

EXILES IN THE AEGEAN: a personal narrative of Greek politics and travel. By BERT BIRTLES. *London: Victor Gollancz*, 1938. 9×5½ *inches; 412 pages; illustrations.* 16*s*

It is perhaps unfortunate that the author has devoted most of his book to the political side of his visit to Greece, where he arrived in the autumn of 1935. He and his wife lived long enough in the country to get to know something about it; they travelled in the north, and visited a number of the lesser-known islands in the Aegean. Sandwiched in with the description of contemporary politics there is much of interest about the life of the people.

ASIA

LIVING WITH LEPCHAS: a book about the Sikkim Himalayas. By JOHN MORRIS. *London: William Heinemann*, 1938. 8½×5½ *inches;* xiv+312 *pages; illustrations and sketch-maps.* 15*s*

The author has spent four months studying a small community of Lepchas, living in a remote valley in the province of Sikkim in the Himalayas. Two or three decades ago, when records of primitive cultures consisted of little more than casual observations of native life, his book would have ranked as an average account of a primitive people. But to-day there exists a systematic body of theory and methods of investigation, without a knowledge of which it is impossible to produce a balanced and relevant account of any primitive culture. This does not imply that every book on primitive peoples should be weighted down with charts, diagrams, and abstruse sociological analyses. It is possible to write a superficial account comprehensible to the untrained reader without distorting the reality of primitive culture, provided that there exists in the background a comprehension of contemporary scientific problems and conclusions. It is also possible to produce a pleasant *causerie* of amusing episodes, interesting casual observations, and witty comments which make no attempt to describe the life of the people; and those parts of Major Morris' book which are devoted to these are excellent. But since most of it is concerned with a description of Lepcha culture, it can no more be excused by the plea that it is "not intended for experts" (p. 10) than a garbled and misleading account of health and disease could be justified by being "not intended for medical practitioners."

This book in fact contains most of the standard blunders of ethnographic research and presentation which have made difficult the task of serious scientific analysis, while facilitating the formulation of wild theories of primitive life both in ethnology and in popular opinion. The author has no conception of the inter-relationships of the pigeon-holed compartments of culture which he

describes. The prolix myths, isolated rites and superstitions, and dreary narratives of religious ceremonies which permeate the book are completely detached from everything which makes them interesting and worth while to the natives, and take us back to the days when we thought that savages had nothing to do but carry out ritual, observe taboos, and tell one another stories about gods and demons. Only in dealing with sex does the author give any indication of the bearing of his facts upon the wider scheme of social integration, and even here the cultural background is too hazy to allow definite conclusions to be drawn. Economic life is practically ignored, but we are told that the Lepchas live in a condition of "primitive socialism," the neologism being apparently employed under the illusion that old confusions may be justified by applying new terms to them. Finally, there is no critical attitude towards the validity or significance of information, and no distinction between authentic customs and socially significant values and beliefs on the one hand, and artificial answers by informants to hypothetical problems on the other. This detachment from social reality is illustrated on p. 264, where the author, after telling us precisely what happens if a man wishes to divorce his wife, naïvely adds that no divorces have occurred within living memory in the community studied by him, and that they are rare elsewhere. Here, as with many of his observations, it appears that he has simply written down at dictation uncorroborated and unreliable items of native gossip and speculation.

All this is particularly unfortunate since, when he is not, metaphorically speaking, studying religion by copying out the prayer-book, Major Morris has an entertaining style, a critical attitude towards the relative merits of primitive and civilized cultures, and a sympathetic insight into human nature and relations. But he has apparently been led to overlook the fact that modern anthropology requires the same sort of patient, detailed, and systematically orientated observations as the physical or biological sciences, that no amount of intuition or astuteness will compensate for a lack of solid and relevant facts, and that there exists to-day a substantial body of anthropological theory and field technique which may be challenged, tested, or elaborated, but which cannot be blandly ignored. R. P.

THE VALLEY OF FLOWERS. By F. S. SMYTHE. *London: Hodder and Stoughton*, 1938. 9×5½ *inches;* xiv+322 *pages; illustrations and route-map* 18s

Mr. Smythe made his first exploration of the Garhwal Himalaya in 1931. In 'Kamet conquered' he describes the Bhyundar valley, remarking that it would always remain for him the valley of flowers, "a place of escape for those wearied of modern civilisation." Six years later he returned to Garhwal, partly to climb, partly to wander and collect plants. In 1931 there had been a party of six Europeans; in 1937 Mr. Smythe was for some of the time alone with four Sherpas, with whom he climbed Nilgiri Parbat (21,264 feet). He was later joined by P. R. Oliver, and this small party reached the summits of Peak 22,481 and Mana Peak (23,860 feet). This is a significant change, and is illustrative of the growing dislike for large and generally unwieldy expeditions and of the return to the methods previously adopted with such success by Longstaff and Kellas. A new feature in this book is the presence of sixteen colour photographs. These are slightly disappointing. Though the colours are in general natural, the plates lack the sharpness which it is presumed the original negatives possessed.

This book is therefore partly a record of climbs and traverses. The descriptions of thunderstorms, of the heat and flies in the valleys, the scenic sequence

from the Plains to the main range and particularly the relationship between Mr. Smythe and his Sherpas, evoke interest and pleasure. But it is more than a simple narrative, and frequently the worst aspects of western civilization are contrasted with the peace and lack of commercial exploitation in the Garhwal Himalaya. This too is often aptly expressed, but Mr. Smythe is less fortunate when he would convince us of the necessity and value of escape. His pleading leads him sometimes to a morass of clichés: which would perhaps have been avoided had more of the thought been used which he advocates should be abandoned. For the replacement of thought by an uncontrolled meditation which allows us to read "the message of the hill tops and stars" and to enter into the "very soul of beauty" is liable to lead nowhere; the statement that "through all this tangled skein of life must run the golden thread of beauty" surely means very little. Apart from these defects, this book is an interesting record of an expedition that achieved much, without initial advertisement and with only the minimum of equipment and transport. J. B. A.

UNBEKANNTES TIBET: durch die Wildnisse Osttibets zum Dach der Erde. By ERNST SCHAFER. *Berlin: Paul Parey*, 1937. 9 × 5½ *inches;* viii + 296 *pages; illustrations and maps.* [*M.*5.75]

This is the first of two volumes dealing with an expedition into western China and eastern Tibet mainly to collect birds and mammals, of which some two thousand six hundred specimens were safely brought back and divided up among various museums in Germany and the Academy of Natural Sciences, Chicago. Dr. Schaefer, who went as chief ornithologist and assistant zoologist, states however that his book is intended to be less a scientific work than an account of the adventures and conditions experienced by the party on their journey of eighteen months; and, as such, it makes excellent light reading, although, judged by English standards, the style is inclined to be rather florid. The Foreword should not be taken as an indication of the general tone of the book: "So wollen wir Forscher nicht nur Verkünder objektiver Wissenschaft, sondern selbstbewüsste Soldaten des deutschen Geistes sein" is a typical excerpt; but this spirit is not over-emphasized elsewhere, and the book itself is interesting throughout and most exciting in parts. Unfortunately the title is to a certain extent misleading, for the first volume is concerned wholly with China, and in the second there can be very little "unknown Tibet" described, if the route-map at the end of the book is any criterion. In fact, no more than a small area near the sources of the Yangtze, for almost all the country through which the expedition passed had previously been seen by English, French, or Russian explorers. The two maps are quite unworthy of the book, and are on so small a scale that they are extremely hard to follow. The scale of the one is 1 : 28,000,000 and of the other (though none is given) about 1 : 14,000,000, the names and heights having to be read with the aid of a magnifying glass.

The party left Shanghai in the summer of 1934, under the leadership of Brooke Dolan, an American, and travelled up the Yangtze to Chungking, and thence, *via* Chengtu, to Batang (where the first volume comes to an end), hunting and collecting all the way. Western China seems to be one of the few places left in which real adventures can be relied upon, and of these the Dolan Expedition had a very fair share, from floods to bandits and executions, from snow-blindness to bears. Dr. Schaefer is not always correct in his statements; for instance, he translates "Rimpoche" as a title meaning "His Re-born Holiness" instead of as the adjective "precious"—but that is of minor importance, and, as a spirited account of the personal side of a lengthy expedition, his book leaves little to be desired. R. K.

IN SEARCH OF THE MAHATMAS OF TIBET. By EDWIN G. SCHARY. *London: Seeley Service*, 1937. 8½×5½ *inches; 312 pages; illustrations and sketch-maps.* 15*s*

Mr. Schary started his fruitless quest in 1912. Having no money whatever, he was forced to work his way from the United States *via* Honolulu and Australia to Calcutta, and thence northwards, before he was even within striking distance of the Himalayas; and this makes a fascinating story out of a journey that could scarcely have failed, in any event, to be of the greatest interest. He first reached Leh in the spring of 1915, firm in the belief that somewhere beyond the mountains he would find the legendary Mahatmas, and be able to join them as a disciple. Partly for this reason, that it would be a poor start to a life of asceticism to travel in comfort; and partly because he could not afford to do anything else, he crossed the Tunga La into Tibet with nothing more than a horse, a couple of fur robes, and two saddle-bags containing *tsamba*, dried apricots, tea, salt, and a cup. So bold an effort deserved better luck, but, in point of fact, after four days both he and the horse were starving and on their last legs; and the horse having died, it was only a fortunate meeting with a band of missionaries which saved his own life.

Undeterred, he left Leh again, in the summer of 1918; this time taking the main road past Hanle to Gartok, and travelling in a still more Spartan manner as a beggar, without more supplies than he could carry himself or so much as sixpence in his pocket. And the extraordinary thing is this, that apparently knowing a mere seven or eight words of Tibetan, and thus quite unable to pass as anything but what he was, he succeeded in making a journey past Manasarowar, down the Tsangpo to Shigatse, and back to India through Gyantse. As far as Shigatse his route has been done by only two other Europeans—the Fathers Desideri and Freyre in 1716—and in the circumstances it is not surprising that he crawled into Gyantse (in the words of David Macdonald) "a begrimed and filthily clad figure, covered with festering sores." It was a very remarkable achievement, and, as long as he confines himself to the facts of the journey, Mr. Schary is well worth reading.

It is when he occasionally breaks off into explanations that he becomes unreliable, doubtless because of difficulties over language. For instance, it is not true that, on the death of "some high-priest," the heads of the prominent Tibetan families are instructed to "go ahead and produce a child apiece," one of the children being subsequently recognized as the incarnation of the late lamented. "Tashi Lumpo" (correctly "Lhünpo") is not an alternative name for the Tashi Lama, but that of his dwelling near Shigatse. It is not correct to say that within a half-day of Kailas Parbat are the headwaters of rivers running to India, Burma, and China. Transliterated phrases such as "Jhel de caro" leave a good deal to be desired. None the less, the book is a modestly written account of a fine exploit, carried through in the face of great hardships; and these minor errors do little to spoil one's enjoyment of it. R. K.

AFRICA

AFRICA EMERGENT: a survey of social, political and economic trends in British Africa. By W. M. MACMILLAN. *London: Faber and Faber*, 1938. 9×5½ *inches; 414 pages; maps.* 15*s*

'Africa Emergent' Professor Macmillan calls his latest book. Yet when the reader turns the last page of this carefully ordered and finely tempered study of a grave problem, he seems to see, not an emergent Africa, but a grim Lucina sitting cross-legged at the threshold of the unhappy continent's destiny. There

is no birth, only obstruction, fruitless throes, and vain travail pangs. The white races have thrust in without vision or forethought beyond the desire of immediate private advantage, or, as missionaries, towards whose indiscretions the author turns a lenient eye, they have not joined wisdom to their idealism. The American aborigines and the Australian "black fellow" dwindled; the lustier African persists and compels our attention to the muddle we have made of his world. Professor Macmillan traces the present confusion to its causes with impressive thoroughness, clarity, and restraint. He knows the African's case at first hand: he knows, too, that there is no artificial remedy. He sees that the way of salvation lies in stirring the general conscience to right the wrongs committed by the pioneers. He has no sentimental illusions concerning "the noble savage," and he recognizes that that is not the point at issue.

Two fallacies are exposed and illustrated; one, that Africa has vast expanses of fruitful land, and the other, that she offers inexhaustible supplies of cheap labour. Natural conditions and human wastefulness have drastically diminished the value of the first, and the other superstition is routed by figures. There are not enough men to serve the needs of the white man's industrial enterprise without undermining the domestic life of the natives and handicapping the tillage of his lands and the development of his pastoral interests. Professor Macmillan makes clear, beyond all gainsaying, that it demands the utmost that abundant capital and enlightened scientific organization can supply to develop the resources of the continent, and that one of the prime causes of the present chaos has been the inadequacy of the private individual of small means and scantier knowledge and understanding.

He suggests the possibility of a better state of affairs in applying the lessons learnt from the success of the wealthy and scientifically controlled mining enterprises in the Transvaal and the Belgian Congo. He shows how they have discovered the indefeasible connection between their own prosperity and the material well-being of the natives on whose co-operation their profits depend, and so both gain. It would seem to follow that the Governments who have partitioned Africa must apply like principles and practice to their responsibilities towards "the ultimate purpose of helping Africa to support its own civilized needs."

This is a study that none interested in these great issues can afford to ignore, and its spirit and method are such that it will not soon lose its force and instructiveness. J. P. R. W.

L'EGYPTE INDÉPENDANTE: par le groupe d'études de l'Islam. (Publications du Centre d'Études de Politique Etrangère. Collection du monde islamique. Tome I.) *Paris: Paul Hartmann*, 1938. $8\frac{1}{2} \times 6\frac{1}{2}$ *inches;* 456 *pages; map.* 25 *fr.*

This volume, which is the first of a projected series of studies of the Islamic world of to-day, embodies the work of a group of investigators, whose purpose, like that of Chatham House in this country, is to present impartial surveys of the facts relevant to international problems. It is fitting that Egypt, which acquired full independence in 1937, was chosen for the first of these studies. The future leadership of the many Arab peoples, from Morocco to Arabia, who possess a common language and religion and, perhaps also, similar political aspirations, certainly lies within the reach of Egypt by virtue of its population numbers, its wealth, its cultural standing, and its geographical position.

The main topics discussed in this book may be briefly indicated. It sketches first the remarkable political development of Egypt during the last hundred and fifty years from the status of a Turkish province to that of an independent

national state. Thanks to the application of capital and western technique, chiefly by the British, the economic basis of Egyptian life has been enlarged and consolidated. Perennial irrigation and the cultivation of cotton made possible a very rapid increase of population in the all-important alluvial area along the banks of the Nile; it is only 3 per cent. of the whole country but it contains and sustains almost the whole of Egypt's 15½ millions, a population six times that of 1800. Part III, which deals with the economy of Egypt, is perhaps the most interesting section for geographers. There is much up-to-date detail about internal routes of all kinds, and the industrial possibilities of the country are examined. The great lack in this respect is coal; but there are some mineral resources, including iron (near Aswan), and a large part of Egypt, notably the Libyan desert, has never been prospected.

Part IV of the book studies the Egyptian Press, one of the elements in the country's prestige and an important source of enlightenment throughout the Arabic-speaking world. Egypt's nodal position on the airways between Europe, South Africa, and the Far East increases its ability to collect and disseminate news.

W. G. E.

THE NILE, the life-story of a river from the source to Egypt. By EMIL LUDWIG. Translated by MARY H. LINDSAY. *London: George Allen and Unwin*, 1936. 9×5½ *inches; 352 pages; illustrations and maps.* 16*s*

THE NILE IN EGYPT: the life-story of a river. By EMIL LUDWIG. Translated by MARY H. LINDSAY. *London: George Allen and Unwin*, 1937. 9×5½ *inches; 344 pages; illustrations and map.* 16*s*

Between the years 1930–34 the author visited Uganda and the Blue Nile on a journey through the Sudan to the region of its sources in Western Abyssinia and also along the lower course of the river through Egypt. He tells us he has tried to efface traces of the literature which he studied to deepen or complete his impressions. He is amazed to find that much of what he saw, the strivings of human beings, agriculture, scenery, and history would not be as they are if the river did not exist. Such are the bases of these volumes which set out to describe the course of the Nile from its sources until it discharges into the Mediterranean.

The theme of the river as a living organism has to be maintained with a good deal of imagination. It has to be followed in space along its course, and in past time by outlining the pageants of history and human activity relating to it in various places. The first volume opens with an account of Uganda where the Ripon Falls are adopted as the source of the Nile. The river is then followed to Khartoum where it is said to meet the Blue Nile in brotherly embrace in one of the loveliest spots in the world. The basins of the Blue Nile and the Atbara are then described with glances at Abyssinia and the history of its people. Considerable space in a rather critical vein is devoted to the Dervish episode with the story of the fall of Khartoum, Gordon's death, the reoccupation under the late Lord Kitchener, and the Fashoda affair. Modern developments and the present administration are dealt with before following the Nile through Nubia to Aswan where the first volume closes. The second volume follows the Nile through Egypt dealing generally with its ancient history and more seriously with modern developments and politics. There is a decidedly anti-British bias in these matters. Thus we reach the delta, which we are told is over thirteen thousand years old, and then the shore of the Mediterranean. In places the Nile is building up the floor of its valley at the rate of about 4 feet in a thousand years, but has that rate been constant over so many thousands of years and does it apply to the whole of the delta?

There are about fifty photographs distributed between the two volumes. They are not referred to in the text and sometimes are remote from the sections which they illustrate. A photograph in the first volume shows two hippos and is labelled "Rhinoceros." In the second volume another photograph shows people building masonry, probably a dam, in a foundation trench in a rocky formation and is labelled "Digging a canal."

The authorship ensures wide circulations for these volumes and it is a catastrophe that they are full of errors, especially in regard to topography and natural history. They may be suggestive, but are of no use for reference. In the foreword we are told of the river that it flows straight from south to north and over a length of 2750 miles varies only 250 feet in breadth. An errata slip explains "for 250 feet in breadth read 250 miles in longitude." We read of baobab trees and carmine convolvulus in the forest of Uganda with great ferns half rotting over the water. There is said to be yellow savannah in Uganda. The quantities of Nile cabbages, *pistia*, which dot the surface of the Albert Nile and are a striking feature are not mentioned. We are told that no crocodiles gambol at the foot of the Murchison Falls. Then, a couple of pages later, it is said that they have been counted in their thousands below the Murchison Falls. Actually the pool at the foot of the falls is thick with crocodiles presumably waiting for dazed or damaged fish. The Nile is said to be powerfully reinforced from its second source, Lake Albert, but the lake is practically a backwater and adds almost nothing to the river. It is said that only recently by means of air photographs of the Sadd region has it been possible to ascertain how much a great watercourse shifts about during a decade. About thirty years ago iron kilo poles were set up as reference marks along the sides of the river and it still flows past them: there has been practically no shift. The 4-mile channel connecting the Bahr el Jebel and the Zeraf is said to be 60 miles long. The most southern examples of the baobab occurring near the White Nile are probably those on J. Zeraf a few miles south of Malakal, but the author having mentioned it as existing in Uganda, refers to it as appearing as a new variety among the vegetation near Renk. Then some pages later, having forgotten that he has told us it is nearly hollow, he says that the soft wood of the trunk can be hollowed out and that with its diameter of 45 feet it will then hold anything up to 2000 gallons of water. Baobabs are not normally hollow and those used for water storage in Kordofan have been artificially excavated. Actually, the average capacity is about 300 gallons and very few of them exceed 1000 gallons. The Nuba Mountains are referred to as the Mountains of Nubia which are about 800 miles distant. We are told of the presence of the ebony and mahogany trees along the river many hundreds of miles from the habitats of either of them, and none who know the place would recognize his entirely fictitious description of the Sabaloka Cataract; at none of the cataracts of the main Nile are the islands refreshed by the eternal spray of rushing waters. They are of hard, impervious crystalline rock and where there are rapids there can only be small patches of soil in a few sheltered places where trees may find a footing.

The author goes astray concerning the people. We are told there are Badawin on the Atbara, 500 Nubians at the Gordon College in Khartoum, and that Berber is the capital of the Berbers. The Niam Niam are said to be "most carefully painted with flower and star signs, which they renew every other day in red and brown colour." He quotes as an Arab proverb "When Allah made the Sudan, Allah laughed." This saying came from some British officer, and though it amuses strangers who know more favoured lands it is quite unknown and also meaningless to the people of the Northern Sudan who are only acquainted with that region.

In the second volume a larger proportion of the space is devoted to historical and political matters, and there are fewer errors. It is stated that while the British had omnipotent advisers in every other department, the Education Department alone was handed over to Armenians and other foreigners. During the Cromer regime there was a very large British staff of teachers in the schools. The result of their efforts is manifest in the many educated Egyptians now filling responsible positions. This tale of errors might be more than doubled, but enough has been said to show their nature and their occurrence in every sphere. The volumes are pleasantly and attractively written, but this makes them more dangerous in spreading misinformation widely. G. W. G.

MISSIONE DI STUDIO AL LAGO TANA. [Under the leadership of GIOTTO DAINELLI.] Volume primo. Relazioni preliminari. *Roma: Reale Accademia d'Italia* (*Centro studi per l'Africa Orientale Italiana*. 2), 1938. 10×7 *inches; 174 pages; illustrations and map*. *L.25*

The wide scope of the programme of an Italian scientific mission which visited the Lake Tana region of Abyssinia in the spring of 1937 may be judged by the headings of some of the chapters of this report; they include geology, zoology, botany, and anthropology with interrelated subjects such as indigenous agriculture and systematic measurements of the lake's depth, each of which was dealt with by specialists under the leadership of Professor Dainelli.

As the title indicates, the contents give a preliminary account of results of their investigations, and it can easily be understood that some time must elapse before all the material which was collected can be worked out. When the final results are published they will almost certainly emphasize the need for another expedition; only a few months were spent in the country, which is an inadequate allowance of time to do more than prepare the way for a longer stay. At least a year, including one rainy season, is necessary to study the botany alone, for many of the flowers bloom in summer and autumn during or immediately after the rains. The scientists were well equipped and had wisely made a thorough study of previous literature on the area; such authorities as d'Abbadie, Blanford, and Grabham are freely quoted.

Among many interesting chapters is that on the geology of the Simen Mountains which contains a sketch-map with contours of the bare region round the summit of Degien (4620 metres), the highest mountain in Abyssinia. This peak is the Ras Dashan of the British map (Africa, 1/2M, 1922) where the height is given as 4560 metres. It would be in the interests of geography if a common spelling of the name and a value for the height of this predominating peak that would be accepted by cartographers of all nations could be agreed upon. Amhara officials living in the district when questioned by the reviewer did not recognize the name Ras Dashan but called the highest point Bohit, which is shown on the sketch-map as an adjacent but slightly lower peak (4510 metres).

Another chapter describes the racial characteristics of the small but interesting tribes that reside in the Lake Tana area, such as Falasha and Waitos, on which no serious work by a competent anthropologist working in the field had previously been undertaken.

The text is fully illustrated by some excellent photographs. R. E. C.

THE NEW ABYSSINIA. By Major E. W. POLSON NEWMAN. *London: Rich and Cowan*, 1938. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 284 pages; illustrations and route-map*. *15s*

Major Polson Newman gives in this book his impressions of Italian East Africa in the spring of 1937 when he paid a flying visit to the two old Italian colonies,

Eritrea and Italian Somaliland, and the recently conquered land of Abyssinia. The expedition was of necessity a conducted tour, he and his wife were the guests of the Italian Government, contacts with Abyssinians were not encouraged, and the point of view given is the Italian one. Most of the journeys were made by air with landings at garrisoned points so that it was not possible to learn much about the actual state of the country. Ample space is given to economic development, tribal administration, colonization by Italian peasants, public works and mineral and agricultural resources, but in all these there are more often an outline of plans for the future than records of achievement.

R. E. C.

THE UNVEILING OF TIMBUCTOO: the astounding adventures of Caillié. By GALBRAITH WELCH. *London: Victor Gollancz*, 1938. 9×5½ *inches; 352 pages; illustrations and route-maps.* 16*s*

Mr. Galbraith Welch's account of René Caillié's life in Africa and the exploration of Timbuktu would have been so much more readable if he had been either a little less enthusiastic about his hero or had learnt greater moderation in his writing. He has written up the explorer to such an extent that the fulsomeness of his account makes it difficult to be as fair to the extraordinary perseverance, courage, and initiative which René Caillié displayed as he really deserves. Caillié was determined to get to Timbuktu. He had no resources and no backing. He went to Africa in a humble capacity with that disastrously mismanaged French expedition which was to reoccupy St. Louis and Gorée (Dakar). There seemed to be no particular reason why his French employers should assist him financially or otherwise to explore for he seemed to have no qualifications; and they did not do so. He eventually saved up enough money during his employ by the British in Sierra Leone to buy a small parcel of trade goods and to set out on foot in the guise of a devout Moslem seeking his way to Egypt. In this precarious manner he succeeded, not only in going to Timbuktu and in crossing the Western Sahara to Morocco, but, most important of all, in bringing back a very adequate map of his route and copious information of the countries through which he passed in his seventeen months' journey.

Caillié was neither the first European to go to Timbuktu nor necessarily the first white man to return from there. Laing went there and was killed on his way home. Mungo Park, we presume, did not go there, though it is not absolutely certain that he did not do so before he was drowned in the Busa Falls on the Niger. But certain merchants from the Mediterranean did go there and came back, and there is a curious record of a boatload of Europeans, who got to Timbuktu, in the papers of the Denham, Oudney, and Clapperton Expedition (in the archives of the Royal Geographical Society), derived from circumstantial information collected in the Fezzan. None of these travellers however left any record or descriptions and Caillié did, in great detail. Thus both the circumstances and the results of the Caillié expedition wholly justify the author's praise and admiration, though not the manner of their expression. He is less than fair to Barth, whose journeys of over four years in Equatoria produced a corpus of information which has never been bettered, in referring to him as a mercenary traveller. In fact, the German accompanied Richardson as a result of the request addressed to Queen Victoria by the Prussian Academy of Sciences. When Richardson died soon after reaching Nigeria Barth could either have come home or continued to do his work for Prussia. In loyalty to his leader and the British, who made his journey possible, he submitted his material to the British Government and public, who in turn gave him their fullest support and admiration. It is not by detracting from other people's work that Caillié's

reputation will be enhanced nor yet by the loose and unscientific criticism with which the author has interspersed his chapters. Nevertheless, this account of Caillié and his work, the first in modern times to appear in this country, is valuable in introducing to the British public so attractive and remarkable a subject.

The author's own observations derived from what seems to have been a rather hurried journey in some of the areas traversed by Caillié are somewhat ingenuous. The volume lacks an index and the sketch-map provided is inadequate. F. R.

ST. HELENA, 1502–1938. By PHILIP GOSSE. *London: Cassell and Co.*, 1938. $8\frac{1}{4} \times 5\frac{1}{2}$ *inches;* xiv+446 *pages; illustrations and maps.* 15*s*

As the result of much personal research the author has written an interesting and valuable account of St. Helena, which has been a British possession for 255 years, though few English people know anything about it except that it was the place of Napoleon's captivity. This episode has been liberally documented, and in these pages is treated in proportion as part of the long island story. The colony is now in a bad way: its palmy days were under the paternal and generous rule for 182 years of the East India Company. The transfer from the Company in 1834 was a blow from which it has never recovered. The last two chapters of the book seem to contain the most vital matters. Of these the latter, with an eloquent description of the scenic beauties of the island (and the author is well versed in fauna and flora), has a bearing on the future, for St. Helena in its physical features and climate is suited for visitors.

With a thorough knowledge of their history and development during well over four centuries, Mr. Gosse has some trenchant remarks to make on the present condition of the islanders, and some suggestions for future improvements. Some of the burial grounds are in a condition of shameful neglect. There is no education higher than elementary. The populace have no vote or voice in government. There is no factory legislation, and the slum property in Jamestown and the hovels in the country are hopelessly overcrowded. The smallholder wants encouragement, 60 per cent. of the occupied land being in the possession of two owners. The islanders have only agriculture to look to, but the cost of the importation of fertilizers is prohibitive. The cost of living is kept unduly high because of the heavy freightage charges of the line which practically holds a monopoly. Wages are very low: in the flax mills they are slightly under 1*s* 9*d* for a nine-hour day. Added to this in 1936 customs duties were imposed on even such necessities as sugar, clothing old or new, boots and shoes, cement, coffee, tea, matches, and soap. Apart from duties, the original high cost of freightage, and the unchecked prices of the shop-keeper make the purchase of commodities well-nigh impossible. Indeed, if it were not for Napoleon and postage stamps St. Helena might revert to the condition in which the Portuguese found it in 1502.

But in spite of all this Mr. Gosse finds the inhabitants happy and intelligent. Their endurance is explained by their history, which is unfolded in these pages in great but always interesting detail. The curses of the island have been rats, arrack and rum punch, goats, "these horned and four-legged locusts," and white ants. Several mutinies and rebellions make exciting reading. For one reason or another most of the crops, industries, and institutions tried have failed: the observatory is in ruins, and a mackerel-canning industry came to nothing. And yet the climate of the island is generally thought by visitors to be the finest in the world. Mr. Gosse's readers will surely feel that properly encouraged along new lines there must be a better future in store for St. Helena.

S. E. W.

SOUTH-WEST AFRICA IN EARLY TIMES: . . . up to the date of Maharero's death in 1890. By HEINRICH VEDDER. Translated and edited by CYRIL G. HALL. *London: Oxford University Press*, 1938. 9×5½ *inches;* xvi+526 *pages; illustrations and maps.* 15*s*

It is a special merit that this book, originally published in German in 1934, has been translated and edited in a slightly abbreviated form in English, for until it appeared there was no standard work on this subject. To have filled this gap is an achievement in itself, but the author has done much more. He has assembled the "best written and oral sources" obtainable on this subject and produced a most readable account of them. The book only goes as far as 1890, and some material of a more political and historical character, which might have been included for the latter years of this period, has purposely been left for another study on "German South-West Africa" which the author promises for the future.

The book contains a detailed account of the country and its people, and of the customs and languages of the different tribes, for which task the author is especially well equipped by his ethnological and linguistic studies. In spite of this very complex material, it is by no means dryly written. Some very entangled developments in the struggle between the various native chiefs and their tribes, which was mainly a fight for grazing-ground and cattle, read like adventure stories, with the difference that here they are not based on the author's imagination. It is "the struggle of small, barely civilized races; a struggle to gain space to live, a struggle upward to gain an appointed place amongst the nations of the world." And the author claims rightly that "even if this drama was acted in the far-distant stage of South-West Africa, without any countries or nations paying any attention to it, that is no good reason for regarding it as of little consequence" (p. 41).

Moreover, there is not only a great amount of information as regards the natives, but also much about the first attempts by missionaries and their heroic and lonely struggles. For the Cape Government, and later the German Government, did not lend much support to them and were not willing to back by armed force the appeals for peace which they addressed to the natives engaged in warfare with each other. Interesting light is also thrown on the treaties of alliance and of protection made by these two Governments with the native chiefs and on the attitude of the latter towards them.

In view of the fact that South-West Africa as a Mandate of the Union—it is, incidentally, two-thirds as big as the Union itself—has already known several commissions of inquiry into the unsatisfactory state of affairs among the natives and into many other problems besetting the country, Dr. Vedder's scholarly and interesting book is particularly valuable, for it provides much of the background needed for understanding the conditions and difficulties of South-West Africa to-day. G. M. F.

THE VEGETATION OF SOUTH AFRICA. By R. S. ADAMSON. (Monographs of British Empire Vegetation.) *London: British Empire Vegetation Committee*, 1938. 9×5½ *inches;* xvi+236 *pages; illustrations and maps.* 10*s*

The British Empire Vegetation Committee was established by the first Imperial Botanical Conference in 1924, and the Conference instructed the Committee to arrange the publication of a series of monographs dealing with the vegetation of the Empire. This book by Professor R. S. Adamson, Professor of Botany in the University of Cape Town, is the first of these monographs.

In his preface the author says that the vegetation of the Union has been looked upon from the standpoint of the broader features of its structure, local

details being disregarded: a wise step to have taken in a work of this nature, since purely local details would have little interest for the general reader. Floristic characters and enumeration of species have equally wisely been reduced to a minimum.

Professor Adamson's descriptions are based on and only intended to apply to vegetation within the confines of the Union, although adjoining territories are mentioned incidentally. Under each type of vegetation the virgin condition is described and some account given of the changes brought about by human activities. The general practice of confining works of this type to selected regions of the Empire is open to question. Moreover, from a geographical and from an economic botanical point of view, the division of Africa into different Colonies, apart from the Union, is fortuitous, and some of these boundaries are almost parochial: such, for example, as the divisions between the Colonies in East Africa and those in West Africa where great blocks of a similar countryside are split up into British and French Colonies. A work of the type here under review would have been of more value to the general inquirer and worker in this line of research if it had proved possible to include the territories adjoining the Union of South Africa, to which it is perhaps possible they may be one day joined. An attempt should be made to draw up these monographs on the broadest geographical lines, not confining them to individual parts of a countryside because they happen by chance to form an individual colony. Where possible co-operation should be undertaken with the French, Belgians, and Portuguese, in order to produce monographs giving a survey of a larger area of a similar type of country.

The first chapters of Professor Adamson's book deal with matters known to geographers such as physiography and general description of the Union, climate and weather, geology and soils, followed by a chapter on general ecological factors and vegetation. Chapters V to IX are confined to the author's divisions and treatment of the vegetation, divided into Bush (sclerophyll), Forest, Savannah, Grassland, and Semi-Desert Vegetation. An interesting chapter follows on land utilization and natural products, in which the different sources and types of wealth are dealt with: livestock (including the ostrich), crops, fruit and timber, minerals and mining, and so forth. The chapters on the different types of vegetation are admirably illustrated.

From the geographical, apart from the botanical and forestry aspects of the book, Chapter XI, entitled "General conclusions and prospects," is the most interesting. The author at first attempts some comparisons with other regions, and considers that the other land masses in the southern hemisphere are the most satisfactory, especially Australia and South America. From the purely botanical viewpoint Professor Adamson's views may be acceptable, but it is apparent that they may be open at present to considerable doubt. It is noted that the present political and natural boundaries do not of necessity agree with botanical ones—a point already referred to for wider areas of the Empire.

With the author's conclusion that "there is very little reason to doubt that destruction of, and interference with, natural vegetation is producing conditions of increasing aridity over large portions of the country," few will disagree; it applies also to large regions in Africa outside the Union. Professor Adamson points out that changes in vegetation due to natural causes, such as change of climate, are much more difficult to demonstrate, owing to the extreme slowness with which they come about, but he adds that these changes will certainly come about under unfavourable conditions due to interference. "In other words," he says, "what may be termed secondary changes of the conditions,

which, when of long duration, can bring about effects just like those of change of climate," may be induced.

In conclusion, the author may be congratulated in having written a book in which there is much of high value and interest for the geographer studying the problems presented by the drier and more arid regions of the world; and the Committee responsible for the monographs of British Empire Vegetation on the very adequate manner in which Professor Adamson has followed the general plan laid down for the work. E. P. S.

MY LIFE IN SOUTH AFRICA: a narrative of 70 years' pioneering in mid-east Africa. By Captain David Forbes. *London: H. F. and G. Witherby*, 1938. 9×5½ *inches; 252 pages; illustrations.* 10*s* 6*d*

This is primarily a book of adventure: it must be judged so and not as a piece of geographical writing. The geography of Swaziland, where many of the scenes are laid, is, unfortunately for us, taken for granted by the author. For the historian there is an abundance of intimate sketches of famous men who, three or four decades ago, moved across the veld and its battlefields. The author is a man of action, and it is fitting that his story should be told in simple and unaffected prose. Swaziland, in the earliest days of pioneering, is described in terms of wild game hunting, gold prospecting, native feuds and combats, so that the dramatic note is well maintained. In addition, there is the narrative of the author's participation in the Anglo-Boer War. Occasional lapses from usual spelling should be corrected: they include "veldt" on p. 9 and elsewhere, and "Mallan" for Malan' on p. 240. W. F.

NORTH AMERICA

PHYSIOGRAPHY OF EASTERN UNITED STATES. By Nevin M. Fenneman. *London: McGraw-Hill Publishing Co.*, 1938. 9×6 *inches;* xiv +714 *pages; illustrations and maps.* 36*s*

The aim of the author, the preface tells us, is "to establish order rather than to describe the United States." Nevertheless the work is mainly descriptive, though the details are selected for their value in illustrating broad principles.

Each of the thirteen chapters is devoted to a topographical province, the subdivision of the whole area being somewhat modified from the familiar plan. Thus, from Alabama and Florida to New York we have five belts parallel to the coast-line—Coastal Plain, Piedmont, Blue Ridge, Ridge-and-Valley, and Appalachian Provinces. North of New York the Coastal Plain is lost by submergence, the Appalachian province is continued across the Mohawk by the Adirondack, and the three intervening belts merge into a single New England province, where glaciation-features are dominant.

The unglaciated area west of the Appalachians and south of the Ohio River forms an "Interior Low Plateau" province, with the Blue Grass area as its nucleus. The Mississippi divides the Central Lowland into Eastern and Western Provinces, north of which a wedge of the Canadian Shield constitutes a (Lake) "Superior Upland Province." Finally the Ozark Plateau and Ouachita Province complete this eastern half of the U.S.A.

The book lacks a single small-scale map on which the boundaries of these thirteen provinces can be seen at a glance, though it is otherwise well illustrated by maps and sections, block-diagrams and photographs, the last rather misty. Few pages are without footnotes giving references to literature.

Sampling the descriptions casually, we note the "Coves" of the Great Smoky Mountains, in the Tennessee part of the Blue Ridge Province: these are tectonic

windows, where the erosion of overthrust ancient rocks reveals the younger limestone below. "Each fertile limestone valley is culturally and economically, as well as geologically, an 'inlier' of the Great Appalachian Valley" (p. 175).

Again, on pp. 468–472, we find a statement of the alternative theories of the pre-glacial drainage of the Niagara region: Spencer holding it to have been as now to the St. Lawrence, Grabau conceiving it as south-westwards to the Mississippi. "Those who have given most study to the Pleistocene history of the Great Lake region do not yet find the evidence sufficient to decide the direction of pre-glacial drainage." To the reviewer the great advantage of Grabau's theory is that it postulates a normal consequent drainage in the direction of dip, afterwards reversed by glacial disturbances. If the opposite theory should prove true, it would become necessary to seek for the causes of a reversal of drainage before glaciation.

We note with interest the account of the Baraboo range in Wisconsin, as a Pre-Cambrian mountain exhumed by the removal of the Cambrian sediments in which it was buried (p. 463); and that the "Driftless Area" west of Lake Michigan is not quite without drift. A. M. D.

CANOE ERRANT ON THE MISSISSIPPI. By Major R. RAVEN-HART. *London: Methuen and Co.*, 1938. 9×5½ *inches;* viii+244 *pages; illustrations and map.* 10*s* 6*d*

With the increasing popularity of canoe travel this book will be found a welcome addition to its literature. Besides giving a full and interesting description of the main river itself, it is a mine of information and ideas for the would-be adventurer in the Middle West. He need not be deterred by tales of the crowded traffic of Mark Twain's days, for he will find the modern river surprisingly free of craft, and given over almost entirely to the vessels employed in the work of flood control. Major Raven-Hart acquired a great respect for the men employed in this skilful work: a respect which is easily appreciated by the reader, and which adds considerably to the general interest of the book. J. S.

CENTRAL AND SOUTH AMERICA

EL DESCUBRIMIENTO DE PUERTO RICO. By José GONZÁLEZ GINORIO. *San Juan, Puerto Rico,* 1936. 10½×7½ *inches;* xii+328 *pages; facsimile maps.* Also 'Suplemento bibliográfico.' 69 *pages; published* 1938

Although, according to Las Casas, the Isle of Porto Rico was seen for the first time by Columbus in January 1493, during the return journey from his first expedition to the West Indies, it was only during the second voyage, on 19 November 1493, that he actually reached the isle. In regard to the place where the discoverer landed for the first time in Porto Rico, opinions are conflicting among authors who have dealt with the problem. Some, like Muñoz, believe that the first landing took place at Aguada-Aguadilla on the north-west; others, like Navarrete, prefer Mayaguez, on the middle of the western coast of the isle; and several choose Boquerón on the southern part of the western coast, or Guayanilla, on the extreme west. It seems that all these differences come mainly from the various interpretations of the same description of Peter Martyr of Anghiera. Since the "Diario" of Columbus' second voyage has been lost, we can judge only from the accounts of contemporary writers, including Peter Martyr, Andrés Bernaldez, Las Casas, Fernando Columbus, Oviedo, and Herrera, as well as from other documents.

Sr. José González Ginorio, of Porto Rico, took up the whole matter, and made use of documents which before had not been studied in full: the letter of Dr.

Chanca, who accompanied Columbus on the second voyage, published by Navarrete in 1824; the report of Guglielmo Coma, another companion of Columbus, printed in 1494 or 1495; an account dated 1494, of Michael Cuneo, another companion of Columbus on the second voyage, and a letter of Simone del Verde, of 1494, both published in the *Raccolta Colombiana*. Sr. Ginorio compared all the texts, discussed the matter extensively, and arrived at the conclusion that Columbus on the second voyage sighted the north-east coast of the island of Boriquén, or Porto Rico, on the afternoon of 17 September 1493, ran along the north coast during the whole of the 18th, and on the 19th arrived at the large bay of Aguada-Aguadilla, on the north-west of the island.

The author opens the introduction to his book by saying that it is a study of critical history, and thus subject to controversy. The last word on the question has certainly not yet been said, if it ever will be. It is rather hazardous to make definite affirmations on anything connected with Columbus; nevertheless the book is full of them. After more than four centuries a veil of mystery lingers obstinately over the greater part of the discoverer's life and deeds; and even in the smaller details, like the question of deciding where he landed for the first time in Boriquén, there is much divergence. A. Z. C.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

GEOMORPHOLOGIE. By Otto Maull. (Enzyklopädie der Erdkunde.) Teil [5]. *Leipzig: Franz Deuticke*, 1938. 10×7 *inches;* xvi+502+40 (*plates*) *pages; illustrations and maps. M.*40

This is one volume of the extensive series "Enzyklopädie der Erdkunde." The matter is, for the most part, physiography in the sense that it deals with land-forms. It is on the whole clearly written and covers a wide and interesting field. After a general introduction dealing with the basis of the subject it passes on to discuss the general development of the landscape through fluvial and associated processes, the effects of earth movements, karst landscapes, snow and ice work, wind erosion, and deserts, and finally marine and coastal forms.

The treatment is partly descriptive, and most sections are prefaced by short but interesting historical summaries. In the four hundred odd pages of the volume it is clear that detailed discussions cannot always be given, but for the most part the accounts are well-balanced and up-to-date. On the other hand, in the chapter on coastal forms, very little is said about the problems of raised beaches and related phenomena, and in the extensive bibliography no mention is made of the several reports of the International Commission on Pliocene and Pleistocene terraces. The question of coral reefs is also somewhat summarily dismissed. Perhaps the very large number of references given in the bibliography encourages the reader to think that fuller accounts will be found in the text. At the same time however the bibliography is most useful for general purposes, as it is classified under subjects.

Broad treatment of some of the big questions, such as continental drift, isostasy, and sea-level displacements, are given but little space, but this should not be taken as a serious criticism, as they are dealt with in other volumes of the series. The student of land forms will certainly find here a careful and useful résumé and criticism of the details of his subject. At the end of the volume there are some good photographs and the text diagrams are usually good, though more would have been welcome. There are useful short tables giving the equivalents in German, French, and English of various terms, *e.g.* as applied to karst features.

Taken as a whole the book fulfils a useful purpose and is well produced. It should certainly find a place in all geographical libraries. J. A. S.

THE AIR AND ITS MYSTERIES. By C. M. Botley. *London: G. Bell and Sons*, 1938. $7\frac{1}{2} \times 5$ *inches;* xvi+296 *pages; illustrations and maps.* 8*s* 6*d*

This is a popular book in the best sense, written in a flowing easy style, packed with varied information and eminently readable. The author has a happy knack of illustrating her arguments by apt anecdotes or odd items of information which will be new to many meteorologists, as in her opening description of the three stained glass windows of Winchelsea, representing the Land, the Ocean of Water, and the Ocean of Air. It is through the length, breadth, and especially the depth of the Ocean of Air that we are taken on a rambling cruise, with occasional excursions into the byways of history.

This quality of what might be called "purposeful inconsequence" makes the book difficult to review, but one can say that it covers nearly all branches of meteorology more or less adequately. Some parts are superficial, while the diagrams are often crude: the relative sizes of the water-drop and the ion in Fig. 10 are decidedly startling, and surely a better representation could have been found of the distribution of winds and pressures. Also the author has at times an annoying habit of anonymity, referring for example to "a well-known meteorologist" or "an enterprising amateur" when it would have been just as easy and far more useful to give names. On the other hand the material is unusually up to date, including references to events in the present year. The seventeen full-page plates are uniformly excellent and show great enterprise in their collection.

As would be expected from Miss Botley's enthusiasms, the long chapter on "Cloudland" is the best in the book, closely followed by the descriptive parts of "The drops that water the earth" and "The atmosphere and light." There are also some good descriptions in "The realm of sound." The theoretical parts suffer from occasional errors or half-truths, some of which are probably due to over-simplification, the fruit of a conscientious desire to spare the non-technical reader. Thus on p. 10 the typhoon reading of 886·8 mb. is stated to be the lowest atmospheric pressure ever measured, leaving the important qualification "at sea-level" to be understood.

The book as a whole is admirably suited for its purpose, and will surely give many amateurs an active interest in meteorology. For these the author caters in a supplementary list of "books to read," but the fare is meagre and a very much better selection could have been made from among the numerous excellent books of recent years. There is a satisfactory index. The book is good value for the modest price. C. E. P. B.

PHYSICAL GEOGRAPHY FOR INDIAN STUDENTS, being a completely revised and enlarged edition of Simmons and Stenhouse's 'Class-book of physical geography.' By Cyril S. Fox. *London: Macmillan and Co.*, 1938. $7\frac{1}{2} \times 5$ *inches;* xii+564 *pages; illustrations and maps.* 7*s* 6*d*

With the aid of photographs and a number of maps Dr. Fox, of the Geological Survey of India, has completely revised for use in India Simmons and Stenhouse's 'Class-book of physical geography.' The result is a substantial volume in which the old-fashioned steel engravings of the original appear side by side with modern half-tone blocks and in which references to modern researches appear on the same page as quotations from works published sixty years ago. The revision has clearly involved much careful work and authors of English text-books will read with envy the preface in which it is recorded that the six

coloured maps were provided by the Survey of India at a nominal charge and that most of the photographs are from official sources. There is so much of the greatest value and interest in the additions which have been made that it is to be hoped Dr. Fox will not abandon his project for a comprehensive and entirely new physical geography of India. L. D. S.

ARBRES ET FORÊTS. By LÉON PARDÉ and MAURICE PARDÉ. (Collection ARMAND COLIN. No. 212.) *Paris: A. Colin*, 1938. 7×4½ *inches;* 224 *pages.* 15 *fr.*

Forestry is such an extensive subject and impinges on human affairs in such a variety of ways that the task of writing a popular account of it is onerous. The authors of this book in covering a wide field have produced an account that is at once concise and well informed without loss of interest. Their achievement depends largely on the treatment of the subject from the geographical aspect which lends a unity to the whole.

The book is divided into four parts, the first of which defines the different kinds of woodlands and their management, with special reference to French practice, with a chapter on the climatic, edaphic, and biotic factors affecting the growth of forests. In the second part the forests of the world are discussed and the interaction of climatic and geographical factors in producing the existing zonation of forests is emphasized and used in their classification. From the statistics given of the forest areas in different countries the dependence of forests on the climatic conditions and the absence of a direct correlation between population density, even in Europe, is apparent. The excess of volume of timber used over the natural increment in the forests each year in almost every country is a matter for grave disquiet. The native and naturalized trees of France with their distribution are dealt with in the third part and notes on the more recently introduced exotics are given. Then follows a discussion of the occurrence of the various species in the natural forest regions of France. The final part is given up to brief accounts of the minor forest products of the world, and of water relationships of the forest and national parks and reserves.

While of interest to professional foresters and students the book will appeal also to geographers and to the average man desirous of enlarging his knowledge of a basic industry. To those wishing to inquire further into particular aspects of the subject the bibliography will prove useful. One criticism must be made: a number of systematic names used are not valid under the International Rules of Botanical Nomenclature. It is to be hoped that these will be corrected in a future edition, and perhaps maps of the forest regions of the world and of France could be added. R. M.

ECONOMIC AND HISTORICAL GEOGRAPHY

WITH STANLEY IN AFRICA. By WILLIAM HOFFMANN. *London: Cassell and Co.*, 1938. 9×5½ *inches;* viii+294 *pages; illustrations and map.* 12*s* 6*d*

The reopening in this book of a closed chapter of African history might at the first blush seem uncalled for, but the unusually intimate relations borne by the author to one of the outstanding figures in that history may perhaps be an excuse. In 1884, on the eve of the Berlin Conference, Mr. Hoffmann (then but a youth) was casually brought to Stanley's notice when sent to his hotel by his employer, a bag-maker in the City; and with characteristic rapidity of action, the explorer offered him the chance of becoming his personal servant. The offer was accepted, with the result that the present author shared the African experiences of his Master (as he is proud to call him) until their close, besides accompanying him

to Berlin and the United States. He thus came to know him in a very special way, and it speaks well for both master and man that the feelings of mutual trust and respect, ripening into real friendship, should have suffered no check under the trials and hardships inseparable from travel in the African wilds.

Stanley is throughout a hero to the author, who, in speaking for example of the painful episodes in the Emin Pasha Relief Expedition which caused so many heartburnings and recriminations, naturally sees things from the explorer's point of view, though careful to avoid too hard words for the other side. In the many talks which they had by the camp fires and elsewhere Stanley seems to have put off his wonted reticence, and he spoke a good deal of the trials of his early days, but, as Mr. Hoffmann says more than once, with a surprising freedom from bitterness.

While this part of the book may have some value by helping us to see Stanley from a rather different angle than usual, the latter part, telling of the author's African work in the employment of the British East Africa Company and the Congo State, is of less interest now that the events of those days have become almost ancient history. On the whole he shows himself well informed, though he is surely not strictly correct (even if the mistake is often made) in speaking of the regulation of the Congo frontiers with other Powers as having been the work of the Berlin Conference as a whole. E. H.

CHISHOLM'S HANDBOOK OF COMMERCIAL GEOGRAPHY. (Thirteenth edition.) Entirely re-written by L. DUDLEY STAMP. *London: Longmans, Green and Co.*, 1937. 9×5½ *inches;* xii+884 *pages; maps and diagrams.* 25*s*

The first edition of Chisholm's Commercial Geography was published almost fifty years ago; the tenth, the last which the author himself prepared, thirty-six years later. Two subsequent editions were revised and edited by Dr. Dudley Stamp, and for the present edition, the thirteenth, Dr. Stamp is wholly responsible. His task was one of considerable difficulty. During the many years of its existence Chisholm's work had become a classic, and it was highly desirable to retain as much as possible of what he had written; on the other hand account had to be taken of the many fundamental changes in the economic geography of the world within recent years. By skilful editing—a slight addition here, a slight omission there, the substitution of more recent statistical information in some places, a somewhat different orientation in others—Dr. Stamp has been able to preserve a surprisingly large amount of what Chisholm wrote. To take a few illustrations selected at random: the introduction and the sections on climate, soil, and the products of the temperate zone have been little altered, but a new section has been added on the climatic regions of the world, and there is a short account, which might have profitably been extended, of recent soil research. More than half of what appeared on the British Isles in the tenth edition has made its way into the thirteenth, and the proportion in the case of the United States is even higher. It is also a good feature of the book that many of Chisholm's statistical tables have been retained and brought up to date; others have been modified, and some are entirely new.

A considerable amount of new matter has been introduced to replace that which was either out of date or had lost its significance. For example, the chapters on European Russia and on Ireland have been re-written and that on Japan re-modelled. Many of the additions have however been worked into the text and it is a tribute to Dr. Stamp's skill that this has generally been done without a breach of continuity. On the other hand we do at times wish that he had carried his investigations a little further. His chapter on the U.S.S.R.

does not add greatly to our knowledge, and leaves us with the impression that the difficulties in the way of giving a satisfactory account of the economic geography of Soviet territory have been evaded rather than overcome. In a book of this kind it is perhaps unfair to criticize an author for his omissions, but in some cases Dr. Stamp almost invites us to do so. For example, he attributes the slow growth of the imports of raw cotton into the port of Manchester to "the difficulty of displacing an old market requiring a high degree of organization," but he gives no idea of what this means in actual practice. Again, Dr. Chisholm's hint that the new Erie Canal may not prove the anticipated success has been omitted, but no indication of the present amount of traffic passing through the canal is given. The statement on p. 735 regarding the negro population of the lower Mississippi valley is slightly misleading. In 1931 Mississippi was the only state which had a negro majority.

A list of "alternative" geographical names is given as an appendix, though there is no indication as to which name is to be preferred. Some names are described as conventional; apparently "conventional English" is to be understood. Strictly considered, all forms other than the local official are conventional. The Chinese names have not been brought up to date. The text has been reset in *The Times* Roman type; the tables however have been set in other type and detract from the appearance of the book. Some of the maps have been re-drawn, and others have been added, the great mass of footnotes which the work had gradually accumulated has been much reduced, many of them having been absorbed in the text, the numbering of the separate paragraphs has been abandoned, and the use of heavy black type much restricted. But the form and structure of the book remain the same and Dr. Stamp has undoubtedly done his best so far to fulfil his pledge to the late Dr. Chisholm that "the work which has exercised so much influence on the progress of Geography should not be forgotten by the English-speaking world."

J. McF.

GENERAL

A ROVING COMMISSION. By HENRY NEWMAN. *London: G. Bell and Sons*, 1937. 7½×5 *inches;* 328 *pages.* 7*s* 6*d*

Mr. Newman went through the Boxer Rising, the Younghusband Mission to Lhasa, and the Third Afghan War, as War Correspondent, and served against the Mohmands as an officer in 1916, so that he had no lack of material on which to draw; his book is light, amusing, and packed with excitement. It is written in a pleasant, unassuming way, and the dry details of strategy and tactics have not taken the place of the really interesting things which happened. Mr. Newman's descriptions, and especially those of scenes in Tibet, are so extremely clear-cut and forceful that one is filled with envy at his having had the good fortune to see all these things, and with gratitude that he is almost able to persuade us that we were there too.

R. K.

THE MONTHLY RECORD

THE SECRETARYSHIP OF THE SOCIETY

The Council of the Royal Geographical Society will shortly appoint a new Secretary of the Society, to succeed Mr. A. R. Hinks, C.B.E., F.R.S., who will retire from its service at the end of May 1939. Particulars of the duties and salary may be obtained by application to the Honorary Secretaries, and Candidates for the appointment, who should be under the age of forty-five, should apply to them by letter before the fifteenth of December next.

W. L. Sclater.
J. M. Wordie. *Honorary Secretaries.*

31 October 1938.

HUMIDITY VALUES FOR THE BRITISH ISLES

Averages of humidity for the British Isles in tables and charts constitute Meteorological Office publication 421 (1938, price 9*d*), and are presented in a summarized form likely to be useful for engineering, industrial, medical, and meteorological purposes. The publication is a companion volume to averages of temperature (M.O. 407) and averages of sunshine (M.O. 408). The tables comprise monthly and annual averages of temperature, vapour pressure and moisture content of the atmosphere at midday (13 h. G.M.T.) for forty-four well-distributed stations, together with averages of relative humidity in the morning (7 h.), at midday (13 h.), and in the evening (18 h.). Supplementary tables contain hourly averages of relative humidity and vapour pressure at selected stations. The geographical distribution of average relative humidity and of vapour pressure, which is the most convenient expression of the so-called absolute humidity, is shown for midday by a series of twenty-six charts covering the twelve months and the year as a whole. It is emphasized that these charts are based on a number of stations which is only adequate for the broader outlines of the geographical distribution to be shown.

Absolute humidity in the main follows the temperature, so that we find the highest annual value for midday of vapour pressure, 12 mb., in the south of England and the lowest, 9 mb., in the north of Scotland. In July and August the vapour pressure mounts to 16 mb. in the south but only to 13 mb. in the Orkneys. In January and February values range only from 9 mb. in the extreme south-west of England and Ireland to 7 mb. in the Highlands and the Border country.

Relative humidity at midday varies on the average of the year from 85 per cent. along the north-west seaboard of the British Isles to 70 per cent. in the Midlands of England. In July the percentage is 85 in the north-west and only 60 in the Midlands, whilst in January it is 85 over large areas and rises to 80 in the Midlands.

The complexity of the humidity element of climate is indicated by the fact that whereas in England the absolute humidity is greater in summer than in winter, the reverse holds for relative humidity. Both conditions appear to be of physiological and medical importance, and it should be remembered that relative humidity cannot be used as a simple index of absolute humidity except at constant temperature.

TRANSPORT IN ICELAND

In the Record for the *Journal* for last September there appeared a note on Mr. Rutherford's pamphlet "Transport in Iceland," and it was stated that

the map included was incorrect in showing a motorable road from Höfn to Djúpivogur. Mr. Rutherford has since pointed out that although the road in question is certainly rough, it would be classed by the majority of people as motorable and is marked as a "bilvegur" on Daniel Bruun's map of 1935. It would seem that, although on occasion the road has proved unusable even for experienced parties with ponies, cars have nevertheless been along it. As however the worst river, the Jökulsá Loni, is not bridged, and as there is no assurance that cars could ford the braided streams at any given time, it would appear wiser not to class it with the other motorable roads.

EXPLORATION OF THE LAKE RUDOLF REGION

Admiral L. von Höhnel, who accompanied Count Teleki on his expedition which led to the discovery of Lake Rudolf in 1888, has contributed a paper to the January and April numbers of the *Journal* of the Royal African Society, in which he summarizes the subsequent exploration of that region to 1909, and the changes it has undergone as recorded in the travellers' narratives. To this paper Mr. V. E. Fuchs, who carried out extensive research in this area in 1934 (*Geogr. J.* 86 (1935) 114–42), has added a number of useful notes. The paper is valuable for the evidence it affords of the fluctuations of Lakes Rudolf and Stefanie, of changes in the volcanic area around Teleki volcano, and of the distribution of the neighbouring tribes. In 1888, submerged tree stumps at the southern end of Lake Rudolf showed that its level had recently risen: in Elmolo bay, on the eastern shore, six small islands were observed, about a mile off shore. At the time of Mr. Fuchs's visit, five of these were joined to the mainland. The region to the north of the lake around the Omo river was described by von Höhnel as a low-lying forest-covered wilderness. A line of dead trees ran for 15 miles from the mouth of the Omo into the lake, further evidence of a recent rise in level. Seven years later, the lake was visited by Donaldson Smith and Neumann, from whose reports it appears that the small islands at Elmolo had been submerged, and that the northern border was flooded, resembling a great mangrove swamp. In the last two decades of the century, the lake level was evidently rising; the maximum was apparently reached about 1898, for travellers since that date have reported successive falls in level. Similar fluctuations occurred in the level of Lake Stefanie; the cause being apparently a series of abnormally dry seasons at the beginning of this century.

With regard to the volcanic area around Mount Teleki, the writer records that at the time of his visit there was much recently extruded lava around the Nobuyaton cone, and the slopes of the Teleki volcano, then active, were covered with a fine dust. The lava pipe on its southern side did not then exist, and this was probably the point from which Donaldson Smith observed lava to be flowing. Changes have since taken place in the shore-line east of the volcano. The writer also describes the changes in the distribution and condition of the tribes, resulting from raids from across the Abyssinian border, and suggests that the Turkana originated farther to the west and in the course of their migration displaced the Reshiat.

Mr. Fuchs points out that the large island in the southern part of the lake was named Höhnel Island as early as 1891, and that the name South Island is of comparatively recent origin. It may be noted that on the latest edition of the G.S.G.S. 1/2 M sheet, the island is named "South I. (Von Hohnel's I.)."

A NOMENCLATURE BOARD FOR NEWFOUNDLAND

Newfoundland, through the Nomenclature Board Act, 1938, has provided for the establishment of a board which is to be "the ultimate authority in respect of the pronunciation and spelling of all place names" in the island. The board,

which is to consist of seven persons of whom the Secretary for Posts and Telegraphs is to be chairman, is empowered "to recommend to the Governor in Commission the naming or re-naming of any town, village or settlement or any geographical feature in Newfoundland, and may in addition recommend names for roads, bridges or other man-made ways of communication in Newfoundland not coming under the jurisdiction of any legally constituted municipal or local authority." Decision is to rest with the Governor in Commission, but no name is to be given or changed "until notice of such proposed naming or alteration of name shall have been published in the *Newfoundland Gazette* and one other newspaper published in the Island once every week for a period of three months." Corresponding boards in the United States, Canada, Quebec, and New Zealand are the deciding authorities, and publish their decisions without the public notice required in Newfoundland. The status of the Newfoundland board resembles that of the Advisory Committee on Hawaiian Geographic Names rather than that of the Quebec Geographic Board (Commission de Géographie de Québec). The older boards quickly found themselves in need of guiding principles and particular rules. Those of the United States Board on Geographical Names are now numerous and complex. Those of the Geographic Board of Canada became the model for the Quebec Geographic Board and the Honorary Geographic Board of New Zealand. All four bodies adopted the R.G.S.II System as the basis of their rules for spelling and pronunciation, and the United States Board on Geographical Names, which alone deals with foreign names, aligned its policy with that of the International Map Committee of 1913 in important respects. It is to be hoped that the Newfoundland board will be able to conform, as far as local circumstances allow, with procedure so well established in the English-speaking countries. M. A.

SOILS AS EVIDENCE FOR CLIMATIC CHANGE IN MICHIGAN

Recent researches in soil-science have led to the recognition of types of soil in various countries that could only have been produced under different climatic conditions from those now prevailing. A striking case in point is discussed by Mr. J. O. Veatch in a paper entitled "Pedologic evidence of changes of climate in Michigan," published in *Michigan Papers in Geography* (vol. 8, 1938). He states that the soil profiles of Michigan appear to exhibit as many features inherited from past climates as from the present. After the glacial period, evidence for which in this state as in neighbouring parts of the United States is very conspicuous, tundra conditions are inferred to have prevailed from the presence of characteristic podsols abundantly distributed over the northern portion of the state and often located on dry or well-drained sandy land.

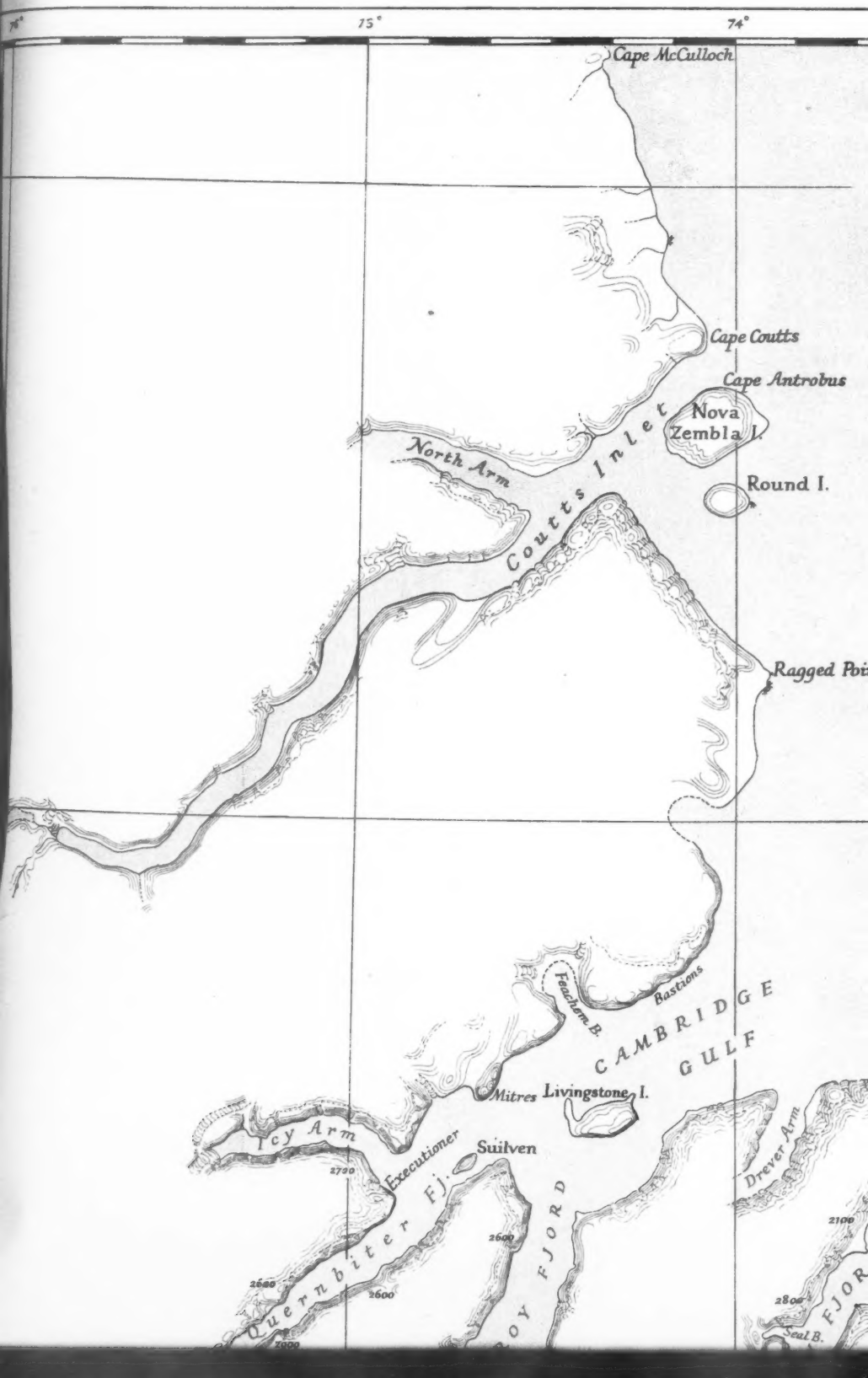
Other soil profiles, particularly in southern Michigan, point to a dry or "prairie" period immediately preceding the present epoch, and it is indicated that the numerous small prairies existing to-day amid the forest belts are relicts of a widespread eastward extension of the prairie country. The postulation of a dry period seems necessary to explain the existence of dry valleys which are a common feature in many parts of the state. These are of "dendritic" structure and can hardly be attributed to glaciation. The disappearance of the streams possibly occurred during the dry period, and the precipitation has not since increased sufficiently to restore them. There is evidence for a general shrinkage during this dry period of inland lakes, around many of which there are soil profiles now relatively dry and exhibiting features characteristic of a wet or water-covered site. There are numerous instances of former lakes which now contain no water at all, and in which any peat that may have accumulated has disappeared or been changed to mineral soil. Some of these dry lake basins

in Muskegon, Oceana, and Newaygo counties exist at present as small prairies overlying thick dark-coloured humous soil which could not have been formed under the present climate on dry sandy parent material. On the shores of Lake Michigan most of the old and higher dunes may have been formed during the predicated drier interval, as likewise the features, clearly of wind origin, on the dry sandy plains inland.

OBITUARY

H.R.H. PRINCE ARTHUR OF CONNAUGHT, K.G., K.T., F.R.S.

Prince Arthur of Connaught was made an Honorary Fellow of the Society in 1924. In his speech at the Anniversary Dinner in that year he disclaimed any title to fame as a traveller or explorer; nevertheless, in the course of a life which was divided between military duty and the responsibility of representing the Crown in the Dominions and abroad, he had to travel far and lost no opportunity of becoming intimately acquainted with the countries he visited. The only son of the Duke of Connaught, he naturally chose a career in the British Army, and as a subaltern in the 7th Hussars he saw active service during the South African War. In 1913 he married the Duchess of Fife. During the Great War he was extra A.D.C. to Sir John French, Sir Douglas Haig, and Sir C. C. Monro in turn, and was later a staff officer in the Canadian Corps. Prince Arthur had already undertaken several important missions, notably to Japan, on behalf of King Edward VII and King George V. In 1920 he went back to South Africa as Governor-General of the Union. The complexities of the political situation made the position a responsible one, but Prince Arthur and his wife endeared themselves to South Africans, and his term of office was prolonged. After his return to England, Prince Arthur was enabled to enjoy more leisure, being relieved of many of his more public duties by the sons of the King, but he devoted much of his time to the charities and philanthropic causes in which he was interested.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Cape McCulloch
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Nova Zembla I.
North Arm
Coutts Inlet
Round I.
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Bastions
CAMBRIDGE GULF
Mitres
Livingstone I.
Icy Arm
Executioner
Suilven
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Drever Arm
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2600
2680
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2000
2100
2800
Seal B.

NORTH WEST TERRITORIES

N.E. COAST OF BAFFIN LAND

between Lat. 71°N and 72°30′N

Based on surveys by T. T. Paterson and others during Mr. J. M. Wordie's expedition 1937

Scale 1/500 000

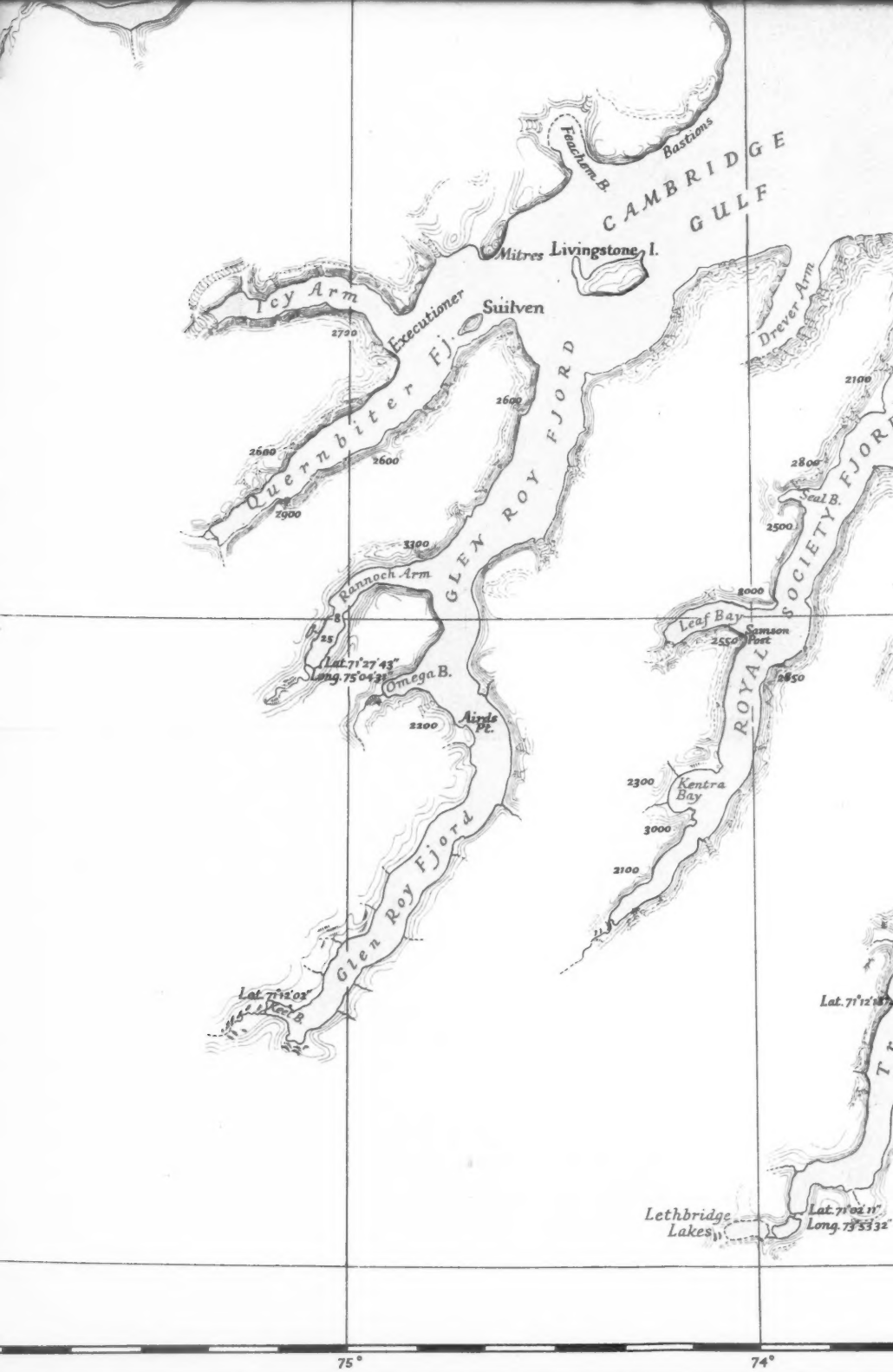
5 0 5 10 15 20 Miles

5 0 10 20 30 Kilometres

Approximate heights in feet

Terraces ≈ *Depths in fathoms*

New names are those proposed by the author



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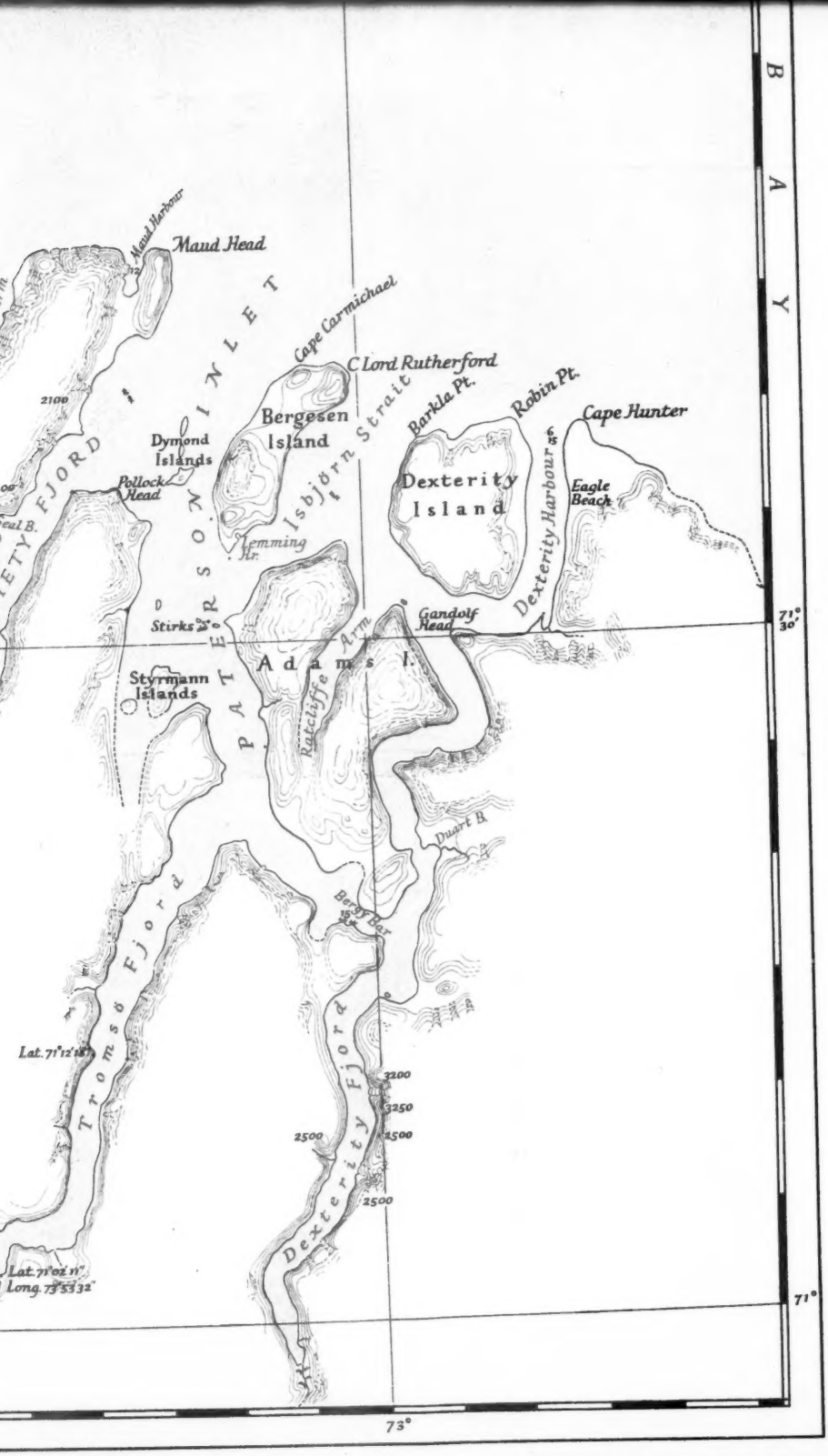

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BAFFIN LAND

Wordie